REGULATIONS AND SYLLABUS

of

M.Tech (INDUSTRIAL ENGINEERING AND MANAGEMENT)

(W.e.f 2019-20 admitted batch)

A University Committed to Excellence

M.Tech in Industrial Engineering and Management
Regulations
W.e.f. 2019-20 admitted batch

1. ADMISSION

Admission into M.Tech in Industrial Engineering and Management program of GITAM (Deemed to be University) is governed by GITAM University admission regulations.

2. ELIGIBILITY CRITERIA

2.1   A pass in B.E./B.Tech./AMIE in Mechanical/Production/Industrial Engineering or its equivalent.

2.2   Admissions into M.Tech will be based on the following:

(i) The score obtained in GAT (PG), if conducted.

(ii) Performance in Qualifying Examination / Interview.

(iii) Candidates with valid GATE score shall be exempted from appearing for GAT (PG).

2.3 The actual weight to be given to the above items will be decided by the authorities at the time of admissions.

3. CHOICE BASED CREDIT SYSTEM

3.1 Choice Based Credit System (CBCS) was introduced with effect from 2015-16 admitted batch and revised with effect from the academic year 2019-20 in order to promote:
- Student-centered Learning
- Activity-based learning
- Students to learn courses of their choice
- Cafeteria approach

3.2 Learning objectives and outcomes are outlined for each course to enable a student to know what he/she will be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM

4.1   The Program Consists of

i) Core Courses (compulsory) which give exposure to a student in the core subject's related area.
ii)   Program Electives.
iii)   Open Electives
iv)   Mandatory and Audit Courses

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3   In general, credits are assigned to the courses based on the following contact hours per week per semester.
- One credit for each Lecture / Tutorial hour per week.
- One credit for two hours of Practical is per week.

4.4 The curriculum of the four semesters M.Tech. Program is designed to have a total of 68 credits for the award of M.Tech. degree

5. MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register for the courses in each semester at the time specified in the academic calendar.

7. ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the semester-end examination and he/she will not be allowed to register for a subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

7.2 However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 65% and 74% on genuine grounds and on payment of a prescribed fee.

8. EVALUATION

8.1 The assessment of the student's performance in a theory course shall be based on two components: Continuous Evaluation (40 marks) and semester-end examination (60 marks).

8.2 A student has to secure a minimum of 40% in any theory course in the two components (ref. 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Project Work/Viva-voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

8.4 Audit courses are assessed through continuous evaluation for satisfactory or not satisfactory only. No credits will be assigned.

Table 1: Assessment Procedure

S.No.	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Evaluation
1	Theory Courses	40	Continuous Evaluation	i) Thirty (30) marks for mid Semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration.
		60	Semester-end Examination	ii) Ten (10) marks for Quizzes, Assignments, and Presentations. Sixty (60) marks for Semester-end examinations
	Total	100		

2	Practical Courses	100	Continuous Evaluation	i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.
3	Technical Seminar (II Semester)	100	Continuous Evaluation	Through five periodic seminars of 20 marks each
4	Project Work (III Semester)	100	Continuous Evaluation	i) Forty (40) marks for periodic assessment on originality, innovation, sincerity and progress of the work, assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation for defending the project, before a panel of examiners. iii) Thirty (30) marks for final report presentation and viva-voce, by a panel of examiners*.
5	Project Work (IV Semester)	50	Continuous Evaluation	i) Twenty (20) marks for periodic assessment on originality innovation, sincerity, and progress of the work, assessed by the project supervisor. ii) Fifteen (15) marks for mid-term evaluation for defending the project, before a panel of examiners*. iii) Fifteen (15) marks for interim report presentation and viva-voce.
		50	Semester-end Examination	Fifty (50) marks for final project report and viva-voce examination assessed by external examiners.
	Total	100		

6	Audit Courses	100	Continuous Evaluation	Audit courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures a minimum of 40 out of 100 marks during the continuous evaluation, he/she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree

Panel of Examiners shall be appointed by the concerned Head of the Department

9. PROVISION FOR ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION

9.1 If a student is not satisfied with his/her grade, the student can apply for answer book verification on payment of a prescribed fee for each course within one week after the announcement of results.

9.2 After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of results, which will be valued by two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned if the student is successful in the appeal by securing a better grade.

10. SUPPLEMENTARY AND SPECIAL EXAMINATIONS

10.1 The odd semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

10.2 The even semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

10.3 A student who has secured 'F' Grade in Project work shall have to improve his/her work and reappear for viva-voce after satisfactory completion of work approved by a panel of examiners.

10.4 A student who has completed a period of study and has "F" grade in final semester courses is eligible to appear for a special examination.

11. MASSIVE OPEN ONLINE COURSES (MOOCs)

Greater flexibility to choose a variety of courses is provided through Massive Open Online Courses (**MOOCs**) during the period of study. Students without any backlog courses up to the first semester are permitted to register for MOOCs in the second semester up to a maximum of 6 credits from program elective / open elective/audit courses. However, the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs.   The grade equivalency will be decided by the respective Board of Studies (BoS).

12. GRADING SYSTEM

12.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab (Absent)	0	-

12.2 A student who earns a minimum of 4-grade points (P grade) in a course is declared to have successfully completed the course and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5.0 for a Pass in the semester.

13. GRADE POINT AVERAGE

13.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma [C \times G]}{\Sigma C}$$

where C = number of credits for the course,
G = grade points obtained by the student in the course.

13.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester.

13.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for Award of Class

Class	CGPA Required
First Class with Distinction	$\geq 8.0^*$
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in the first attempt.

14.   ELIGIBILITY FOR AWARD OF THE M.Tech. DEGREE

14.1 Duration of the program: A student is ordinarily expected to complete the M.Tech. Program in four semesters of two years. However, a student may complete the program in not more than four years including study period.

14.2 However the above regulation may be relaxed by the Vice-Chancellor in individual cases for cogent and sufficient reasons.

14.3 A student shall be eligible for award of the M.Tech. Degree if he/she fulfills all the following conditions.

   a)   Registered and successfully completed all the courses and project works.

   b)   Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated period.

   c)   Has no dues to the Institute, Hostels, Libraries, NCC / NSS etc, and

   d)   No disciplinary action is pending against him/her.

15.   DISCRETIONARY POWER

Notwithstanding anything contained in the above sections, the Vice-Chancellor may review all exceptional cases, and give his decision, which will be final and binding

COURSE STRUCTURE

Effective from the academic year 2019-2020 admitted batch

SEMESTER I

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE701	Data Analytics	PC	3	0	0	3
2	19EIE703	Decision modeling	PC	3	0	0	3
3	19EIE705	Work System Design	PC	3	0	0	3
4	19EIE7XX	Program Elective-I	PE	3	0	0	3
5	19EIE7XX	Program Elective-II	PE	3	0	0	3
6	19EIE721	Data Analytics Laboratory	PC	0	0	4	2
7	19EIE723	Work System Design Laboratory	PC	0	0	4	2
8	19EMC741	Research Methodology and IPR	MC	2	0	0	2
9	19EAC7XX	Audit Course I	AC	2	0	0	0
							21

SEMESTER II

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE702	Facility Planning and Design	PC	3	0	0	3
2	19EIE704	Supply Chain Management	PC	3	0	0	3
3	19EIE7XX	Program Elective –III	PE	3	0	0	3
4	19EIE7XX	Program Elective –IV	PE	3	0	0	3
5	19EOE7XX	Open Elective	OE	3	0	0	3
6	19EIE722	Supply Chain Management Laboratory	PC	0	0	3	2
7	19EIE724	Simulation Laboratory	PC	0	0	3	2
8	19EIE792	Technical Seminar	PC	0	0	4	2
9	19EAC7XX	Audit Course II	AC	2	0	0	0
							21

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE891	Project Work I	PW	0	0	26	13
							13

SEMESTER- IV

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE892	Project Work II	PW	0	0	26	13
							13

Number of Credits

Semester	I	II	III	IV	Total
Credits	21	21	13	13	**68**

PROGRAMME ELECTIVES –M.Tech. (IEM)

SEMESTER –I
Programme Elective-I

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE741	Operations planning and control	PE	3	0	0	3
2	19EIE743	Reliability Engineering and Management	PE	3	0	0	3
3	19EIE745	Maintenance Management	PE	3	0	0	3
4	19EIE747	Total Quality Management	PE	3	0	0	3

Programme Elective-II

1	19EIE749	Soft Computing	PE	3	0	0	3
2	19EIE751	Value Engineering & Analysis	PE	3	0	0	3
3	19EIE753	Management Principles and perspectives	PE	3	0	0	3
4	19EIE755	Forecasting Techniques	PE	3	0	0	3

SEMESTER –II
Programme Elective-III

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE742	Optimization Techniques	PE	3	0	0	3
2	19EIE744	Product Design and Development	PE	3	0	0	3
3	19EIE746	Marketing Management	PE	3	0	0	3
4	19EIE748	Industrial Scheduling	PE	3	0	0	3

Programme Elective-IV

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EIE752	Management of Technology and Innovation	PE	3	0	0	3
2	19EIE754	Advanced Project Management	PE	3	0	0	3
3	19EIE756	Human Resource Management	PE	3	0	0	3
4	19EIE758	Financial management	PE	3	0	0	3

Open Electives

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EOE742	Business Analytics	OE	3	0	0	3
2	19EOE744	Industrial Safety	OE	3	0	0	3
3	19EOE746	Operations Research	OE	3	0	0	3
4	19EOE748	Cost Management Of Engineering Projects	OE	3	0	0	3
5	19EOE752	Waste To Energy	OE	3	0	0	3

Audit Course I and II

S. No	Course Code	Course Title	Category	L	T	P	C
1	19EAC741	English For Research Paper Writing	AC	2	0	0	0
2	19EAC742	Disaster Management	AC	2	0	0	0
3	19EAC743	Sanskrit For Technical Knowledge	AC	2	0	0	0
4	19EAC744	Value Education	AC	2	0	0	0
5	19EAC745	Constitution Of India	AC	2	0	0	0
6	19EAC746	Pedagogy Studies	AC	2	0	0	0
7	19EAC747	Stress Management By Yoga	AC	2	0	0	0
8	19EAC748	Personality Development Through Life Enlightenment Skills	AC	2	0	0	0
9	19EAC750	Developing Soft skills and personality	AC	2	0	0	0

19EIE701: DATA ANALYTICS

L T P C
3 0 0 3

Data Analytics is designed as an introduction to basic statistical tools and quantitative methods for postgraduate students in data planning. As the foundation for more advanced research methodologies and statistical analyses, this introductory course emphasizes developing the necessary skills for expressing statistical ideas in clear simple language, which is an essential skill for effective planning practitioners.

Course Objectives:
- Develop the conceptual and practical knowledge of the students aimed at the intellectual pursuit of Management administration.
- Make them to understand the methods and processes of statistical analysis.
- Expose them to the areas of application of knowledge in business firms and industrial organizations, and
- Enable them to acquire the knowledge of various statistical tools
- Know the process of making conclusions about populations based on information from only samples (statistical inference)
- Know how to specify, estimate, and use statistical models to predict and obtain reliable forecasts (modeling & forecasting)

Unit I   **8L**
Measures of Central Tendency: Introduction, Arithmetic mean, median, mode, geometric mean, harmonic mean, Measures of Dispersion, coefficients of dispersion, skewness, and kurtosis.
Learning Outcomes:
After completing this unit, the student will be able to
- memorize how statistically he could optimize the parameter value for the best results**[L-1]**
- analyze the data and give valid inferences. **[L-4]**
- describe and discuss the key terminology, concepts tools, and techniques used in business statistical analysis**[L-2]**

Unit II   **8L**
Correlation Analysis: Introduction, types of correlation, Methods of Correlation analysis, Scatter diagram method, Karl Pearson's correlation coefficient
Regression Analysis: Introduction, Types of regression models, Significance of Regression Analysis, Methods of finding Regression Equations, Least Squares and Using Regression Coefficient methods
Learning Outcomes:
After completing this unit, the student will be able to
- position to apply ANOVA or Regression analysis based on the experimental data and give valid inference**[L-3]**
- determine the influential factors and also the interaction effects on the response function**[L-5]**
- evaluate the underlying assumptions of analysis tools**[L-5]**

Unit III   **8L**
Hypothesis Testing: Introduction, Types of Hypothesis, Hypothesis Testing Procedure, One sample and Two-sample Test for Mean (Students t-distribution and Z-test); Introduction to Chi-Square distribution, Chi-Square Test for Goodness of fit and for Independence of Attributes.

Learning Outcomes:
After completing this unit, the student will be able to
- able to design, conduct and analyze the experiments more efficiently and effectively. **[L-6]**
- ability to apply linear, nonlinear and generalized linear models**[L-3]**
- solve a range of problems using the techniques covered**[L-3]**

Unit IV   **8L**
Analysis of Variance: Introduction, Testing equality of population means (One –Way Classification), Testing equality of population means (Two –Way Classification)
Learning Outcomes:
After completing this unit, the student will be able to
- ability to perform complex data management and analysis. **[L-3]**
- create quantitative models to solve real-world problems in appropriate contexts **[L-6]**

Unit -V   **10L**
Multiple Regression Analysis, Discriminant Analysis, Principal Component Analysis, Factor Analysis, Conjoint Analysis, Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).
Learning Outcomes:
After completing this unit, the student will be able to
- use professional-level technology tools to support the study of mathematics and statistics**[L-3]**
- understand and critically discuss the issues surrounding sampling and significance**[L-2]**

1. S. C. Gupta & V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons publications, 2012.

References:
1. Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. "Multivariate data analysis", (7th edition). Pearson India. 2015
2. Tabachnick, B. G., & Fidell, L. S., "Using multivariate statistics", (5th edition). Pearson Prentice Hall, 2001
3. Gujarati, D. N., "Basic econometrics", Tata McGraw-Hill Education, 2012
4. Malhotra, N. K., "Marketing research: An applied orientation", 5/e. Pearson Education India, 2008
5. Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. " Applied multiple regression/correlation analysis for the behavioral sciences", Routledge., 2013

Course outcomes:
- demonstrate knowledge of fixed-sample and large-sample statistical properties of point and interval estimators. **[L-3]**
- knowledge of the properties of parametric, semi-parametric and nonparametric testing procedures. **[L-1]**
- ability to perform complex data management and analysis. **[L-3]**
- ability to apply linear, nonlinear and generalized linear models. **[L-3]**
- understanding of how to design experiments and surveys for efficiency. **[L-2]**
- knowledge of classical and repeated measures multivariate methods and computational technique**[L-1]**

19EIE703: DECISION MODELLING

L T P C
3 0 0 3

Decision modeling provides an overview of modeling techniques and methods used in decision analysis, including multi-attribute utility models, decision trees, and Bayesian models. Psychological components of decision-making are discussed. Elicitation techniques for model building are emphasized. Practical applications through the real-world model building are described and conducted, including business management, supply chain, and logistics, transportation, health care, and homeland security.

Course Objectives:
- Improve managerial effectiveness through clearer thinking about complex decision issues
- Emphasis on Integer Linear Programming (ILP), its relation with linear programming and the various types of integer programming,
- Demonstrate how analytical techniques and statistical models can help enhance decision making by converting data to information and insights for decision-making.
- Categorize and construct multistage decision analysis problems using decision trees.
- Categorize and construct multifactor problems with multiple objectives and uncertainty.
- Critically evaluate the decisions of others and develop ways they could have improved their decision making

Unit I   **8L**

Introduction, Theory of Simplex Method, Duality Theory, Duality theorems, Dual simplex method, revised simplex method, Bounded variables algorithm, Sensitivity analysis.
Learning Outcomes:
After completing this unit, the student will be able to
- Interpret how to translate a real-world problem, given in words, into a mathematical formulation. **[L-2]**
- Recognize the mathematical tools that are needed to solve optimization problems. **[L-2]**
- Correlate operational research models from the verbal description of the real system. **[L-4]**

Unit II   **10L**

Integer Programming, Cutting plane method, Branch and bound method, Network Models and Solutions, Shortest Route problems, Minimal spanning tree problems, Maximal flow problem, Complexity of algorithms, Complexity of algorithms for combinatorial optimization problems.
Learning Outcomes:
After completing this unit, the student will be able to
- Describe the logic underlining the idea in the Branch and Bound method and use that method to solve ILPs**[L-1]**
- Describe the logic underlining the idea in the Cutting Plane algorithm and use that method to solve ILPs **[L-1]**
- use computer software efficiently for modeling and solving the ILP problems**[L-3]**

Unit III   **8L**

Introduction to Decision Making, Decision analysis, Decisions under risk, Decision trees, Decision analysis with experimentation, Utility theory, Decisions under uncertainty, Multi-objective Decision Models, Introduction to multi-objective decision making,

Learning Outcomes:

After completing this unit, the student will be able to

- Identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem**[L-2]**
- Identify good decisions and strategies**[L-2]**
- Construct a decision problem graphically and mathematically**[L-3]**

Unit IV   **8L**

Sequential Decision Making (Deterministic Case): Sequential decision models, Dynamic programming, Bellman's principle of optimality, Forward recursion, and backward recursion, Sequential Decision Making (Stochastic Case): Stochastic processes, Markov processes, Markov chains, Markov decision problems

Learning Outcomes:

After completing this unit, the student will be able to

- Identify which parameters have the most impact on the results of an analysis**[L-2]**
- Asses the optimal decision mathematically**[L-6]**

Unit V   **8L**

Algorithms for Unconstrained Optimization, Fibonacci search method, Golden section search method, Hooke and Jeeve's method, Newton-Raphson method, Cauchy's (Steepest descent) method, Algorithms for Constrained Optimization, Penalty function methods, Quadratic programming, Separable convex programming.

Learning Outcomes:

After completing this unit, the student will be able to

- Estimate the need and origin of the optimization methods**[L-2]**
- Classify optimization problems to suitably choosing the method needed to solve the particular type of problem**[L-3]**

Text Book(s):

1. Hillier, F.S. and Lieberman, G.J., Introduction to Operations Research, 8/e McGraw-Hill, 2008.
2. Rao, S.S. Optimization: Theory and Applications, 3/e Wiley Eastern, 2008.

References:

1. Ravindran, A., Philips, D.T., and Solberg, J.J., Operations Research: Principles and Practice, 3/e, John Wiley & Sons, 2006.
2. Taha, H.A., Operations Research: An Introduction, 6/e, Prentice-Hall, 1999.

Course Outcomes:

- Define and formulate linear programming problems and appreciate their limitations. **[L-1]**
- Interpret the results obtained and translate solutions into directives for action **[L-2]**
- Extend and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship. **[L-2]**
- Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications **[L-3]**
- Solve linear programming problems using appropriate techniques and optimization**[L-3]**

19EIE705: WORK SYSTEM DESIGN

L T P C
3 0 0 3

Work system design provides the perfect bridge between production and operations management with human resource management. It deals with the systematic examination of systems in terms of human, machine and process operations with the aim of finding the means of effective and efficient use of resources and setting up of standards of performance for the work being carried out. Concepts such as productivity, scientific management, method study, work measurement will be covered. Concept of Ergonomic aspects of work system design, Value analysis, and various Job evaluation and wage incentive schemes are also included in the course contents.

Course Objectives:
- ➢ Illustrate the role of work system design in production & operations management
- ➢ Gain knowledge of method study to improve the methods of doing work
- ➢ Impart the knowledge of various work measurement techniques
- ➢ Introduce the concept of ergonomics for the design of man-machine systems
- ➢ Impart the knowledge of Value Engineering
- ➢ demonstrate various Job Evaluation and Wage incentive schemes

Unit I   **8L**
Definition and scope of Work System Design, Productivity, techniques for productivity improvement, Work-Study and Techniques, Method Study, the procedure for method study, recording techniques, Micro-Motion Study, critical Examination.
Learning Outcomes:
After completing this unit, the student will be able to
- • use method study to improve the existing methods **[L-3]**
- • identity the unproductive movements of the work **[L-4]**
- • develop the effective methods of doing work **[L-3]**

Unit II   **8L**
Work Measurement: Definition, techniques of Work Measurement, steps and equipment of Time study, Performance rating, Allowances, computation of standard time, Pre-determined Motion Time Standards, Standard data, the concept of Work Sampling, Work Sampling procedure.
Learning Outcomes:
After completing this unit, the student will be able to
- • Asses the operator's performance **[L-5]**
- • use time study to calculate the standard time of a job **[L-3]**
- • design the time standards using various work measurement techniques **[L-6]**

Unit III   **10L**
Ergonomics: man-machine system, characteristics, classification, functions performed by Man & Mechanism involved, Principles of motion economy. design of information displays and controls, design of workplace & effect of the working environment, stimuli-Information theory, Noise and the theory of signal detection, Human information processing.
Learning Outcomes:
After completing this unit, the student will be able to
- • develop and interpret the man-machine chart. **[L-6]**
- • summarize guidelines for the location of display devices. **[L-2]**

- list the role of work environment conditions on human performance. **[L-1]**
- analyze human performance in different work environments. **[L-4]**
- apply motion economy principles for a good ergonomic design of work areas and equipment **[L-3]**

Unit IV   **8L**
Value Engineering: Value – definition, types, Value analysis, procedure, Creativity, and Brain-Storming, Advantages and Applications
Learning Outcomes:
After completing this unit, the student will be able to
- analyze the elements of a product, process, service, or system. **[L-4]**
- identify and isolate the unknown, unnecessary costs. **[L-4]**
- apply value engineering & value analysis to projects. **[L-3]**

Unit V   **8L**
Job evaluation and Wage incentive schemes: Job description and job analysis, Job evaluation-different methods, Wage Incentives, types of wage incentives, Individual and group incentive concepts and implications, Different types of incentive schemes.
Learning Outcomes:
After completing this unit, the student will be able to
- describe and analyze the jobs **[L-1]**
- evaluate the jobs using various techniques of job evolution **[L-5]**
- determine the wage incentives of workers **[L-5]**

Text Book(s):
1. ILO, Introduction to Work Study, 3/e, Oxford and IBH Publishing, 2008.
2. Andris Freivalds and Benjamin W. Niebel, Methods Standards and Work Design, 13/e, McGraw Hill Education, 2013.
References:
1. M. Barnes , Motion and Time Study, 7/e, John Wiley and Sons, 1980
2. Suresh Dalela, Work Study Ergonomics, 5/e, Standard Publishers Distributors, 2013.
3. M. Telsang, Industrial Engineering and Production Management, 2/e, S Chand publications, 2006

Course Outcomes:
- analyze the existing methods of doing work and develop the improved method through method study technique. **[L-4 & L-6]**
- apply various work measurement techniques to set up the time standards of jobs **[L-3]**
- apply ergonomics principles to workplace design and work organization **[L-3]**
- use appropriate wage incentive plan for the employees of an organization**[L-3]**
- apply value engineering and value analysis to projects to scientifically compare and choose among alternatives **[L-3]**

19EIE741: OPERATIONS PLANNING AND CONTROL

	L	T	P	C
	3	0	0	3

Operations Planning and Control is concerned with the management of resources and activities that produce and deliver goods and services for customers. Efficient and effective operations can provide an organization with major competitive advantages since the ability to respond to customer and market requirements quickly, at a low cost, and with high quality, is vital to attaining profitability and growth through increased market share. The course focuses on basic concepts, issues, and techniques for efficient and effective operation planning and control.

Course Objectives:
- ➢ Identify the different hierarchy of decisions and relation of MPC with ERP
- ➢ Interpret different qualitative and quantitative forecasting techniques and their applications
- ➢ Appraise with Master production schedule techniques and their application
- ➢ Illustrate the Material requirement planning and lot sizing concepts
- ➢ Apply different scheduling and sequencing techniques
- ➢ Enumerate different disaggregation techniques and their application

Unit I   **10L**
Manufacturing Planning and Control (MPC): MPC systems, MPC system payoff, Hierarchy of managerial decisions, MPC system framework, Type of configurations manufacturing system, Options in dealing with the hierarchy of decisions.
Enterprise Resource Planning (ERP): What is ERP, ERP, and functional Units, How MPC fits within ERP, Performance measures.
Learning Outcomes:
After completing this unit, the student will be able to
- describe the concept of enterprise resource planning. [**L-1**]
- apply and interpret basic summary and business modeling in ERP. [**L-3**]
- analyze operations performance measurements and analysis for continuous improvement. **[L-4]**

Unit II   **8L**
Demand Management: Demand management and MPC environment, communicating with other MPC Units and customers, Forecasting framework; Time series analysis - Individual-item, short term forecasting models, forecast errors, Forecast error over lead time, Interval estimate, Special Classes of individual items; Coefficient of correlation.
Learning Outcomes:
After completing this unit, the student will be able to
- apply and analyze forecasting models to develop business enterprise forecasts for product demand, profits, sales, material requirements, capacity requirements, etc. **[L-3]**
- identify forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques **[L-1]**

Unit III   **8L**
Sales and Operation Planning: Nature of sales and operation planning, relevant costs, Sales and operation planning methods.
Economic models-Break even analysis in operations P/V Ratio.
Master Production Schedule (MPS): Nature of MPS, MPS Techniques, Time fencing, and MPS stability, Structuring BOM, Final assembly schedule, Managing the MPS,

Disaggregation techniques.
Learning Outcomes:
After completing this unit, the student will be able to
- analyze break-even point and its variables **[L-4]**
- develop and analyze the bill of materials for master production schedule**[L-3]**
- illustrate disaggregation techniques in master production schedule **[L-4]**

Unit IV   **8L**
Material Requirement Planning (MRP): Nature of MRP, MRP records, MRP logic, Technical Issues, Using the MRP system, System Dynamics, Lot sizing methods, Buffering concepts, and System nervousness.
Learning Outcomes:
After completing this unit, the student will be able to
- explain the importance and function of MRP and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances. **[L-2]**
- review the core features of the material requirement planning and how it contributes to the competitiveness of firms. **[L-2]**

Unit V   **8L**
Production Activity Control: Framework, Shop floor control concepts, Techniques, Performance measures, Gantt chart, Finite loading systems, General job shop scheduling - Static, deterministic job shop - Dynamic, probabilistic job shop.
Learning Outcomes:
After completing this unit, the student will be able to
- summarize different techniques in performance measures **[L-3]**
- list and carry out work independently and to be self-disciplined and self-directed **[L-1]**
- illustrate general job scheduling methods**. [L-5]**

Text Book(s):
1. Seetharama, L. Narasimhan, Dennis W. McLeavey and Peter J. Billington, Production Planning and Inventory Control, 2/e, Prentice-Hall of India Pvt. Ltd., New Delhi, 2000.
2. Panneerselvam-Production and operations Management, PHI, 2nd edition.
References:
1. Thomas E.Vollmann, William L. Berry, D Clay Why bark, and F. Robert Jacobs Manufacturing Planning and Control for Supply Chain Management, 5/e, McGraw Hill, International Edition. 2005.
2. Edward A. Silver, David F. Pyke and Rein Peterson, Inventory Management and Production Planning and Scheduling, 3/e, John Wiley & Sons, 1998.
3. Richard J. Tersine, Production/Operations Management, 2/e, North-Holland, 1985.
4. Production and Inventory Management, Y A. C. Hax and D. Canada Prentice-Hall, Englewood Cliffs, NJ, 1984.

Course Outcomes:
- apply the systems concept for the design of production and service systems. **[L-3]**
- compute forecasts in manufacturing using selected quantitative and qualitative techniques. **[L-3]**
- apply the principles and techniques for operations and control of the production and service systems to optimize/make the best use of resources. **[L-3]**
- develop an integrated framework for master production schedule**[L-3]**
- summarize different techniques in performance measures **[L-3]**

19EIE743: RELIABILITY ENGINEERING AND MANAGEMENT

L T P C
3 0 0 3

The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems reliability and systems maintenance function. The course intends to expose the students to the concept of reliability and to help them learn the techniques of estimating reliability and related characteristics of components/ systems. Moreover, it exposes them to the necessary engineering techniques used for analyzing, planning and controlling maintenance systems

Course Objectives:
- ➢ Provide the student with an outline of the basic techniques applied in the field of reliability and failure data analysis
- ➢ Summarize quantifying reliability for product designs in industrial environments.
- ➢ Illustrate the student with the latest trends happening in the field of reliability and product design
- ➢ Outline the basic concepts of reliability, various models of reliability
- ➢ Analyze reliability of various systems
- ➢ Summarize techniques of frequency and duration for reliability evaluation of repairable systems.

Unit I 10L

Reliability: Definition and Basic concepts, Mean Time between Failures (MTBF), Mean Time to Repair (MTTR), derivation of the Reliability function, Statistical failure modes: Exponential, Gamma, Weibull, Lognormal, and Fatigue life models, Point and interval estimation procedures for the above distributions, Reliability in terms of Hazard rate and failure rate, Hazard models and bath-tub curve, Applications of Bath Tub curve to various product fields.

Learning Outcomes:
After completing this unit, the student will be able to
- • outline the concept of Probability to engineering problems**[L-3]**
- • apply various reliability concepts to calculate different reliability parameters**[L-3]**
- • compute the system Reliability of different system configuration**[L-3]**

Unit II 8L

Factors related to reliability: Availability, utilization factor, system effectiveness, overall equipment effectiveness (OEE), Reliability and maintenance costs, Factors affecting reliability and maintenance costs, basic stages in achievement of reliability, Reliability Block Diagrams (RBD), RBD reduction techniques, reliability calculations for series, parallel, and series-parallel systems, Reliability of maintained and standby systems.

Learning Outcomes:
After completing this unit, the student will be able to
- • estimate the system reliability of simple and complex systems**[L-2]**
- • apply various mathematical models for evaluating the reliability of irreparable systems
  [L-3]
- • identify the ways to improve the system reliability through redundancy and standby modes**[L-1]**

Unit III 8L

Reliability prediction and control: The need for reliability control, feasibility studies, prototype tests, manufacture, and production testing, reliability management, reliability

objectives, the people concerned with reliability, co-ordination, training, Graphical representations for product failures, problems.

Learning Outcomes:
After completing this unit, the student will be able to
- select and verify different prototype tests and production tests **[L-4]**
- appraise people with reliability and training **[L-5]**

Unit IV   **8L**
Maintainability: Definitions and basic concepts, Relationship between reliability, availability and maintainability, Corrective maintenance time distribution, Markovian failure models, Maintenance planning activities, resource mobilization, planning methods, evaluation of maintenance performance, Case studies in maintenance management, Design for X, Economics of overhaul, Addition replacement models-additive damage cases, Zero memory case, Partially observed situation, Planning horizon procedure.

Learning Outcomes:
After completing this unit, the student will be able to
- applying reliability networks evaluate the reliability of simple and complex systems **[L-3]**
- summarize concepts of reliability, availability, and maintainability **[L-2]**

Unit V   **8L**
Analysis of dependent failures: Reliability computations using similar and dissimilar stress-strength distributions (exponential, Weibull, normal and Gamma), Time-dependent stress-strength distributions, fatigue failures, recent trends in reliability evaluation techniques.

Learning Outcomes:
After completing this unit, the student will be able to
- develop system reliability models for different configurations**[L-6]**
- asses reliability of components and systems using field and test data **[L-5]**
- implement strategies for improving reliability of repairable and non-repairable systems
  [L-3]

Text Book(s):
1. L. S. Srinath, Reliability Engineering, 3/e, East-West Press, 2005.
2. Robert Dolvavich, Certified Reliability Engineer Primer, 5/e, Quimper publishers, 2009.

References:
1. N. V. S. Raju, Plant Maintenance and Reliability Engineering, Cengage Learning India, 2011.
2. D. T. Patrick and O'Connor, Practical Reliability Engineering, 2/e, Wiley India, 2008.

Course Outcomes:
- outline the relationship of key concepts in reliability engineering and application to maintenance strategies in a manufacturing environment **[L-2]**
- apply various tools to determine the reliability and availability parameters of a system**[L-2]**
- recognize suitable maintenance strategies to enhance system reliability/ availability of a system **[L-6]**
- recognize the fault detection and correction approaches **[L-2]**
- asses reliability of components and systems using field and test data **[L-5]**

19EIE745: MAINTENANCE MANAGEMENT

L T P C
3 0 0 3

The course is designed to assist the participants to understand Maintenance & Facility Maintenance Management Systems, their philosophies, trends and prospective and be familiarized with Asset Management. The course will discuss the different type of Maintenance Programs, their Policies, and Performance Indicators and Development.

Course Objectives:
➢ The course is designed to assist the students to understand maintenance management system elements, objectives, philosophies, trends, and perspectives
➢ Understand failure causes, the impact of failure on costs, failure of working items
➢ Discuss in detail the theory of Reliability centered maintenance RCM, performance standards, and failure modes.
➢ Provides sound knowledge and understanding of spare parts and inventory management processes and principles
➢ Identifying, structure, and classifying spare parts on their criticality, (re)order parameters, and other spare parts characteristics
➢ Applying basic analysis techniques to optimize the availability of spares and cost-effectively handle obsolete spares

Unit I   **8L**
Maintenance Concept: Maintenance definition, objectives, benefits & effects of maintenance, principles of maintenance**.**
Types of Maintenance systems: Preventive maintenance, Effectiveness of preventive maintenance, Elements of Planned preventive maintenance, Benefits of PPM, planned maintenance procedure.
Learning Outcomes:
After completing this unit, the student will be able to
- Understand Scope of Facilities Management**[L-2]**
- Understand Maintenance Management System Elements, Objectives, Philosophies, Trends and Perspectives**[L-2]**

Unit II   **8L**
Computers in Maintenance: Computer aided maintenance, computerized maintenance models, maintenance decision making, computerized maintenance planning.
Condition monitoring: Basic concepts, levels of condition monitoring, condition monitoring techniques.
Learning Outcomes:
After completing this unit, the student will be able to
- Learn the concept, benefits, and process of Asset Management and develop Asset Management Programmes**[L-1]**
- Study the principle of Total Productive Maintenance TPM, development of TPM in three succeeding generations and implementation of TPM. **[L-1]**

Unit III   **8L**
Reliability in Maintenance: Failure functions and their models, reliability application, design for reliability, reliability improvement and testing.
Economic aspects of Maintenance: Maintenance cost and its impact, Maintenance budgeting, cost control, Maintenance audit.
Learning Outcomes:
After completing this unit, the student will be able to

- Understand Failure Causes, Mechanisms and how to reduce Causes of Failure**[L-2]**
- Study Failure Types, Modes, the process of Failure Mode and Effects Analysis FMEA & consequences of the method **[L-2]**
- Study different Maintenance Programmers, Policies, Performance Indicators, Methods and Techniques**[L-1]**

Unit IV   **10L**

Organizational structure for maintenance: Objectives of maintenance organization, maintenance functions and activities, organizational requirements, types of maintenance organizations.

Maintenance material planning and control: Classification of spares, inventory costs, stores management, spare parts inventory.

Learning Outcomes:

After completing this unit, the student will be able to
- Develop and set up Maintenance Programme **[L-6]**
- Able to establish maintenance strategies according to system characteristics and design transition programs to implement these strategies**[L-2]**

Unit V   **8L**

Manpower planning for Maintenance: Objectives of manpower planning, stages of manpower planning, manpower for maintenance systems**.**

Advances in Maintenance: Optimization of Maintenance activities, risk based Maintenance planning, total productive Maintenance, quality control in Maintenance.

Learning Outcomes:

After completing this unit, the student will be able to
- Understand the fundamental theory of operations and production management**[L-2]**
- Develop ability in formulating suitable maintenance strategies to enhance system reliability of a manufacturing system**[L-4]**

Text Book(s):
1. R.C. Mishra, and K. Pathak, Maintenance Engineering and Management, 2/e, Prentice Hall of India, 2012.

Reference:
1. H.P.Garg, Industrial Maintenance, 1st edition, S. Chand Publisher, 1972.
2. B.S.Dhillon, Engineering maintenance a modern approach, Rutledge reprints, 2002.
3. B.S.Blanchard, Maintainability Principles, and Practices, Mc Graw Hill, 1969.

Course Outcomes:
- Understand the significance of Maintenance and Reliability to improve availability**[L-2]**
- Knowledge of dealing with organizational structure, the use of computers and the integration of maintenance into production organizations**[L-1]**
- Analyze the role and importance of Maintenance in modern industry and the need for reducing the downtime. **[L-4]**
- Efficiently decide the Human resource requirements and resource allocation techniques to ensure successful accomplishment of maintenance implementation **[L-4]**

19EIE747: TOTAL QUALITY MANAGEMENT

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Quality is the success mantra for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world-class competition. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach. At the end of the course, the students are expected to recognize the quality issues in an organization and analyze the ways to solve those using TQM techniques and demonstrate skills in using modern TQM tools and software to analyze problems.

Course Objectives:
- Comprehend the philosophy and fundamental values of TQM.
- Interpret the difference between product-cantered and customer-cantered perspectives.
- Decipher quality perspectives through industry-related case studies
- Analyze the influence and impact of quality on economic performance and long-term success of an organization
- Application and evaluation of best practices to obtain total quality
- Conceptualize the importance of implementing basic and modern quality tools to identify analyze and solve industrial problems

Unit I   **8L**

Quality Pioneers: Deming's approach, Juran"s quality trilogy, Crosby and quality treatment, Imia's Kaizen, Ishikawa"s company-wide quality control, and Feigenbaum"s theory of TQC.

Evolution of Quality Concepts and Methods: Quality concepts, Development of four fitness's, evolution of methodology, the evolution of company integration, quality of conformance versus quality of design, from deviations to weaknesses to opportunities.

Learning Outcomes:
After completing this unit, the student will be able to
- Describe the core concepts of Total Quality Management. **[L-1]**
- explain the evolution of quality concepts **[L-2]**
- explain the TQC principles and concepts for organizations**[L-2]**

Unit II   **8L**

Continuous Improvement: Improvement as problem solving process, Management by process, WV model of continuous improvement, process control and process improvement, process versus creativity.

Reactive Improvement: Identifying the problem, standard steps, and tools, seven steps, seven QC tools.

Learning Outcomes:
After completing this unit, the student will be able to
- Enumerate the techniques to delight customers through continuous improvement of the quality of products and services. **[L-1]**
- evaluate and select the appropriate framework for continuous improvement**.[L-5]**
- apply the reactive methodologies for problem-solving in organizations**[L-3]**

Unit III 8L
Proactive Improvement: Introduction to proactive improvement, standard steps for proactive improvement, semantics, example-customer visitation, Applying proactive improvement to develop new products- three stages and nine steps.
Learning Outcomes:
After completing this unit, the student will be able to
- apply the reactive and proactive improvement methodologies for problem-solving in organizations. **[L-3]**
- understand the need for Quality systems of international standards. **[L-2]**

Unit IV 8L
Total Participation; Teamwork skill, Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement, Strategies for TQM introduction, Infrastructure for mobilization.
Learning Outcomes:
After completing this unit, the student will be able to
- Interpret the importance of team work in problem-solving processes. **[L-5]**
- implement the Quality Management Systems in a different organization environment
    [L-3]

Unit V 8L
Hoshin Management: Definition, Concepts, Phases in Hoshin Management – overview.
Societal Networking: Networking and societal diffusion, infrastructure for networking. TQM as a learning system, a TQM model for skill development
Learning Outcomes:
After completing this unit, the student will be able to
- define the business excellence models implemented in various organizations**[L-5]**
- design & implement TQM projects in organizational situations**[L-6]**

Text Book(s):
1. Shoji Shiba, Alan Graham, and David Walden -A New American TQM Four Practical Revolutions in Management, Productivity Press, Portland (USA) -2001.
2. N Logothetis -Management for Total Quality, Prentice Hall of India, New Delhi - 2002.
References:
1. Roger C Swanson - The Quality Improvement Hand Book, Publisher Vanity Books International, New Delhi, 9th Edition, 1995
2. William C Johnson and Richard J Chawla, -Encyclopedia of Total Quality Management, New Delhi, 1995
3. N.V.R Naidu, K.M.Babu, G. Rajendra - Total Quality Management, New Age International Publishers-2008 edition,
4. Kesavan R -Total Quality Management, I K International Publishing house Pvt. Ltd, 2nd,edition,2008.

Course Outcomes:
- understand the various quality concepts. **[L-2]**
- apply continuous improvement models to satisfy customers. **[L-3]**
- apply proactive improvement techniques to improve the quality of products. **[L-3]**
- develop total participation methods among employees to satisfy internal and external customers. **[L-3]**
- implementation of societal networking and Hoshin management. **[L-3]**

19EIE749: SOFT COMPUTING

L T P C
3 0 0 3

This course aims at introducing the fundamental theory and concepts of computational intelligence methods, in particular, neural networks, fuzzy systems, genetic algorithms and their applications in the area of machine learning.

Course Objectives:
- Summarize the fundamental theory and concepts of neural networks, and several neural network paradigms and its applications.
- Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems
- Illustrate the basics of evolutionary algorithms using genetic algorithms and apply them to solve engineering optimization problems.
- Design, implement and verify computing systems b using appropriate soft computing tools

Unit I   **8L**

Introduction of soft computing: soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth-first search, depth-first search technique.

Learning Outcomes:
At the end of this unit, the student will be able to
- distinguish between soft and hard computing. **[L-2]**
- list the various soft computing techniques. **[L-1]**
- identify the real-life application of soft computing. **[L-2]**
- describe human intelligence and Artificial Intelligence. **[L-1]**
- explain the working of intelligent systems. **[L-2]**

Unit II   **12L**

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning , Fuzzy Inference Systems, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers and Fuzzy Modeling.

Learning Outcomes:
After completing this unit, the student will be able to
- develop the idea of fuzzy sets and fuzzy logic.**[L-3]**
- distinguish between crisp and fuzzy sets.**[L-3]**
- explain the concept of a membership function.**[L-2]**

Unit III   **10L**

Artificial Neural Network: Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed-forward network, Back propagation, Different issues regarding the convergence of Multilayer Perception, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Learning Outcomes:
After completing this unit, the student will be able to
- describe the concept of an artificial neural network.**[L-1]**
- illustrate the architecture of a neural network.**[L-2]**
- Summarize the steps involved to develop a NN. .**[L-2]**

Unit IV 8L

Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GA, analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models.

Learning Outcomes:

After completing this unit, the student will be able to
- describe genetic algorithms and operators while seeking the global optimum in self-learning situations **[L-2]**
- apply GA, SA and other stochastic models to optimization problems. **[L-4]**
- differentiate evolutionary and discrete techniques.**[L-2]**

Unit V 8L

Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Learning Outcomes:

After completing this unit, the student will be able to
- conceptualize and parameterize various problems to be solved through basic soft computing techniques. **[L-2]**
- analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently. **[L-4]**

Text Book(s):
1. K. Prathihar, Soft Computing, Narosa Publishers, 2008.
2. Amit Konar, Computational Intelligence: Principles Techniques and Applications, 1/e, Springer, 2007.
3. Fuzzy Logic with Engineering Applications(3rd Edn.), Timothy J. Ross, Willey, 2010.
4. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson, 2003

References:
1. R.J. Schalkoff, Artificial Neural Networks, 1/e, Tata McGraw - Hill, 1997.
2. D.Chakraborty, S. Nanda, and D. Majumdar, Fuzzy Logic and Its Applications in Technology and Management, 1/e, Narosa Publishers, 2007.
3. D.E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, 1/e, Addison-Wesley Professional, 1988.

Course Outcomes:

Upon successful completion of the course, the students will be able to
- identify and describe soft computing techniques and their roles in building intelligent machines.**[L-2]**
- Recognize the feasibility of applying a soft computing methodology for a particular problem.**[L-2]**
- apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.**[L-3]**
- apply genetic algorithms to combinatorial optimization problems.**[L-3]**
- apply neural networks to pattern classification and regression problems. **[L-3]**
- effectively use existing software tools to solve real problems using a soft computing approach. **[L-5]**
- evaluate and compare solutions with various soft computing approaches for a given problem. **[L-4]**

19EIE751: VALUE ENGINEERING AND ANALYSIS

L T P C
3 0 0 3

New Product development is on the rise and developing these products without compromising quality and cost is a challenge. In such development, it has become necessary to reduce the cost or eliminating the unnecessary cost, while improving the product performance or otherwise quality. This course deals with improving the quality in terms of the requirements of the customer at the same or reduced cost by ensuring adequate system performance. Value engineering is a systematic approach to value improvement and contains seven broader phases. Hence, for product development, both cost and quality-related issues need to be tackled concurrently

Course Objectives:
➢ Develop and learn how to identify and measure the needs that products and processes have to fulfill the need.
➢ Summarize the value methodology and apply some understanding on the products that any firm manufactures to review and improve the material costs.
➢ Develop a conceptual framework for assessing and auditing the technology capabilities of a business organization.
➢ improve familiarity with much of this will be achieved by the extensive use of case studies and apply value engineering to products, processes, as well as projects
➢ Identify the solution with the best value for all stakeholders

Unit I   8L
Introduction to value analysis: Definition of Value, Value Analysis, Value Engineering, Value Management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, applications, advantages and limitations of Value analysis.
Learning Outcomes:
After completing this unit, the student will be able to
- able to acquire knowledge on Value Engineering problem-solving skills and appreciation of the difficulties involved in resolving their complexities **[L-1]**
- Infer the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects**[L-2]**

Unit II   10L
Type of values: Political value; Social value; Economic value – Cost value, Use value, Esteem value, Exchange value; Religious value; Ethical value; Aesthetic value; Judicial value. Function– Types of Functions; Levels of function – Basic function and Secondary function Value Analysis Procedure, Blast, Create, and Refine – Steps involved.
Learning Outcomes:
After completing this unit, the student will be able to
- concept of most effective cost reduction efforts available **[L-2]**
- recognize the various phases of value engineering**[L-6]**
- recognize the various phases of value engineering**[L-6]**

Unit III   8L
Value Analysis Procedure: Blast, Create, Refine, Steps involved, Meaning and Importance of Value Engineering Job plan. Phases of job plan, Orientation phase, Information phase, Function phase, Creative phase, Evaluation phase, Recommendation phase and Implementation phase - Case studies.

Learning Outcomes:
After completing this unit, the student will be able to
- apply Value Engineering and Value Analysis for your projects & Integrate VE within the design process. **[L-3]**
- Interpret the appropriate time to apply Value engineering for building design projects**[L-2]**
- analyze the functional importance and functional cost**[L-4]**

Unit IV   **8L**
Value engineering techniques: Brain storming technique, Gordon technique, Feasibility Ranking technique, Morphological Analysis Technique, ABC Analysis, Probabilistic approach, Make or Buy decisions.
Learning Outcomes:
After completing this unit, the student will be able to
- Explain the concepts of VE with emphasis on functional analysis and life-cycle costing. **[L-2]**
- develop and apply creativity and problem-solving skills. **[L-6]**
- establish the Value engineering methodology**[L-4]**

Unit V   **8L**
Advanced Value Engineering techniques: Function, Cost- Worth Analysis (FCWA) technique, Function Analysis System (FAST) technique, Weighted Evaluation method, Evaluation matrix, Break Even Analysis, Life cycle cost (LCC); Applications of value analysis/ Value Engineering.
Learning Outcomes:
After completing this unit, the student will be able to
- apply Value Engineering and Value Analysis for your projects, scientifically compare and choose between alternatives **[L-3]**
- develop a systematic approach to avoid unnecessary costs **[L-6]**
- recommend the present facts and present costs**[L-5]**

Text Book(s):
1. Anil Kumar Mukopadhaya, Value Engineering Concepts Techniques, and Applications, Response Books, 2003.
References:
1. L.D. Miles, Techniques of Value Analysis and Engineering, 3/e, McGraw-Hill, 1989.
2. P.N. Khandwala, The fourth Eye-Excellence through Creativity, Wheeler Publishing, company, 1988
3. Iyer, Value Engineering, New Age Publisher, 1996

Course Outcomes:
- able to evaluate and analyze ethics and value policies and application of theories. **[L-5]**
- understand standard policies and procedures applicable to value principles. **[L-2]**
- able to pick and choose the best ethical standards and concepts for a given problem. **[L-6]**
- analyze problems related to Brainstorming technique and other feasibility approaches**[L-4]**

19EIE753: MANAGEMENT PRINCIPLES AND PERSPECTIVES

L T P C
3 0 0 3

This course presents thorough and systematic coverage of management theory and practice. The course aims at providing fundamental knowledge and exposure of the concepts, theories, and practices in the field of management, human behavior at the individual, group and organizational levels, Production and operation management in the changing global scenario.

Course Objectives:
- ➢ outline the functions of management and responsibilities of the manager
- ➢ Illustrate in improving the decision-making processes
- ➢ Comprehend provide tools and techniques to be used in evaluating the performance of managerial job
- ➢ Appraise the role of management control using different techniques
- ➢ Enumerate systems approach to problem-solving.

Unit I   **8L**
Management principles: Management functions, Roles & Skills - History of management thought - Various theories and approaches to management- Planning process, tools and techniques.
Learning Outcomes:
After completing this unit, the student will be able to
- summarize fundamental concepts and principles of management, including the basic roles, skills, and functions of management **[L-2]**
- review various theories and approaches to management. **[L-2]**

Unit II   **10L**
Concept of decision and decision making, Decision-making process, approaches and aids - Formal and informal organizations - Organization structure and design - Organization principles of line and staff authority and span of control - Delegation, decentralization, and autonomy
Learning Outcomes:
After completing this unit, the student will be able to
- identify different organization structures and their significance. **[L-4]**
- explain common techniques used to manage group decision making**[L-2]**
- describe the barriers to individual decision-making and common styles of decision-making. **[L-1]**

Unit III   **8L**
Managerial control-need and principles, Role of information in control, Control methods and techniques, Managerial ethics and social responsibility
Learning Outcomes:
After completing this unit, the student will be able to
- appraise the importance of information in management control **[L-5]**
- compare and contrast different types, roles, and styles of managers across organizations. **[L-2]**
- recognize and apply management ethics and social responsibility concepts **[L-1]**

Unit IV   **8L**
Systems approach in problem-solving: Systems concepts: System, Environment, Input, Output, Process, Feedback, and Control - Classification of systems - System analysis:

System design and systems engineering - General systems theory and its application to business problems

Learning Outcomes:
After completing this unit, the student will be able to
- outline the importance of systems approach in problem-solving **[L-4]**
- application of systems theory to business problems **[L-3]**

Unit V   **8L**
Systems design: System purchaser(s), Objectives, Constraints, Design of input, Output process and Feedback control - Examples of application and case studies in different areas of business management.

Learning Outcomes:
After completing this unit, the student will be able to
- incorporate constraints, inputs, outputs, and feedback in system design **[L-6]**
- interpret the importance of system design in business management. **[L-2]**

Text Book(s):
1. L. M. Prasad, Principles & Practice of Management, 8/e, Sultan Chand & Sons, 2014.
2. R.G.Coyle, Management of System Dynamics, John Wily & Sons, Chichester, U.K (1977).

References:
1. H. Koontz, H.Weihrich, Essentials of Management, 9/e, Tata McGraw, Hill, 2012.
2. S.P. Robbins, Fundamentals of Management: Essential Concepts and Application, 6/e, Pearson India, 2009.
3. G.R.Terry, S.G. Franklin, Fundamentals of Management, 8/e, Pearson Asia, 2007.
4. W.R.Plankett, R.F.Attner, Introduction to Management, Kent Publishing Company.
5. S.L Opener, Systems Analysis for Business and Industrial Problem Solving, McGraw Hill, NY, 1975

Course Outcomes:
- Summarize the concept of management and its perspective [**L-2**]
- Outline the concept of authority and concept of delegation, a span of control **[L-4]**
- application of systems theory to business problems **[L-3]**
- recognize and apply management ethics and social responsibility concepts **[L-1]**
- outline the importance of systems approach in problem-solving **[L-4]**

19EIE755: FORECASTING TECHNIQUES

L T P C
3 0 0 3

This course provides you with a working knowledge of forecasting methods. Techniques in univariate forecasting using exponential smoothing, regression methods for time series data, stationary and non-stationary time series models for seasonal and non-seasonal time series data and model selection procedures are covered.

Course Objectives:
- Understand various important concepts in forecasting and different approaches for modeling trend, seasonality, and persistence
- Use the analytical tools that econometricians employ to analyze data
- Tailor-make models for their applications and use them to produce forecasts
- Complete basic programming tasks, including reading and modifying existing codes
- Understand journal articles that use intermediate forecasting methods

Unit I 10L

Introduction: Nature and uses of forecasts, An overview of forecasting techniques, Defining the forecasting problem, methods of forecasting, qualitative and quantitative forecasting, Time series data and models, univariate statistics, Bivariate statistics, autocorrelation. Stochastic process: Time series as a discrete stochastic process, Stationary, Main characteristics of stochastic processes (mean, auto covariation and autocorrelation functions), Stationary stochastic processes, Stationary as the main characteristic of a stochastic component of time series. Lag operator.

Learning Outcomes:
After completing this unit, the student will be able to
- ability to contextualize outputs where data are drawn from diverse and evolving social, political and cultural dimensions**[L-2]**
- ability to reflect on the experience and improve your own future practice**[L-4]**
- ability to apply the principles of lifelong learning to any new challenge. **[L-3]**
- analyze past patterns in time series data and develop appropriate models for forecasting **[L-4]**

Unit II 8 L

Regression-moving average models: Regression methods in time series analysis, simple linear regression, multiple linear regressions, Simple moving averages for a constant process, moving averages for a linear trend process, Exponential smoothing for a constant process, estimation of demand variance, Exponential method for smoothing a linear trend, choice of a smoothing constant

Learning Outcomes:
After completing this unit, the student will be able to
- understanding of appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools. **[L-2]**
- ability to bring together and flexibly apply knowledge to characterize, analyze and solve a wide range of problems**[L-1]**

Unit III 8L

Seasonal data and forecasting errors: Smoothing models for seasonal data, a multiplicative seasonal model, an additive seasonal model. Period and cumulative forecasts, the variance of forecast errors, definition, the variance of period forecast errors, the variance of cumulative forecast errors, prediction intervals. Analysis of forecast errors, Estimation of

variances

Learning Outcomes:

After completing this unit, the student will be able to

- understanding of the balance between the complexity/accuracy of the mathematical/statistical models used and the timeliness of the delivery of the solution.
  [L-2]
- apply methods of forecasting to practical problems including assessing forecast accuracy and criticizing the results to enhance forecasting performance; **[L-3]**
- describe averaging techniques, trend and seasonal techniques, and regression analysis, and solve typical problems**[L-1]**

Unit IV   **8L**

ARMA models: Moving average models MA(q), Condition of inevitability, Autoregressive models AR(p), Yule-Walker equations, Stationary conditions, Autoregressive moving average models ARMA (p,q), Coefficients estimation in autoregressive models. Coefficient estimation in ARMA (p) processes. The goodness of fit in time series models, AIC information criterion, BIC information criterion, Q-statistics. Box-Jenkins methodology to the identification of stationary time series models.

Learning Outcomes:

After completing this unit, the student will be able to

- demonstrate practical experience by having been exposed to problems based on real data**[L-1]**
- prepare oral and written reports on a forecasting model and its accuracy in terms that would allow a non-expert to make business plans and decisions. **[L-2]**
- compare and contrast qualitative and quantitative approaches to forecasting**[L-2]**

Unit V   **8L**

Panel data, Qualitative forecasting: Definition of panel data, Types of panels, Brief History, Benefits and drawbacks of longitudinal data, Exploratory analysis of panels. Basic models: fixed effects, random effects, between and pooled estimators, Traditional vs. modern approaches to panel data. Monitoring, Network Analysis, Scenarios, Morphological Analysis, Relevance Trees, Delphi Method, Cross-Impact Analysis.

Learning Outcomes:

After completing this unit, the student will be able to

- ability to locate and use data and information and evaluate its quality with respect to its authority and relevance. **[L-2]**
- identify the major factors to consider when choosing a forecasting technique**[L-1]**
- describe three measures of forecast accuracy**[L-1]**

Text Book(s):
1. Douglas C. Montgomery and Lynwood A. Johnson, Forecasting and Time Series Analysis, 5/e, McGraw Hill,2002

References:
1. Enders W. Applied Econometric Time Series. 2/e John Wiley & Sons, Inc., 2004.
2. Wooldridge J. M. Econometric Analysis of Cross Section and Panel Data, The MIT Press, 2002.
3. Makridakis, S., Wheelwright, S. C., and McGee, V. E, Forecasting, Methods and Applications, 2/e., Wiley.1983

Course Outcomes:

- demonstrate a sound knowledge of quantitative and qualitative forecasting processes**[L-1]**
- estimate and interpret causal models including bivariate and multivariate regression models. **[L-2]**
- identify and interpret mixed autoregressive and moving average models. **[L-1]**
- improve forecasting accuracy by combining alternative forecasts**[L-6]**

19EIE721: DATA ANALYTICS LABORATORY

L T P C
0 0 4 2

This emphasizes the development of rigorous logical thinking and analytical skills of the student and appraises him the complete procedure for solving different kinds of problems that occur in engineering. Based on this, the course aims at giving adequate exposure in random variables, functions of random variables, regression, and correlation, a test of hypothesis and multivariate analysis technique the objective of this lab is to enable students to have exposure on data analytics using SYSTAT, MS Excel, Statistical, and Minitab

List of Experiments:
1. Linear Regression and Correlation
2. Testing of Hypothesis – I & II
3. Analysis of Variance (ANOVA)
4. Factor analysis
5. Principal Component Analysis
6. Cluster Analysis

Course Outcomes:
After the successful completion of the course, the students will be able to:
- estimate the capability of various processes to identify opportunities for improvement. **[L-2]**
- design simple full factorial experiments for process improvement studies**[L-6]**
- understand the concept of linear and nonlinear correlation, linear and nonlinear regressions, rank correlation**[L-2]**
- understand the concept of testing of hypothesis for small and large samples by using various tests like t-test, F-test, t-test and chi-square test**[L-2]**
- understand the concept of multivariate analysis, its classification and important techniques**[L-2]**

19EIE723: WORK SYSTEM DESIGN LABORATORY

L T P C
0 0 4 2

Work system design is a robust approach to the design, creation, and operation of systems. In simple terms, the approach consists of identification and quantification of system goals, creation of alternative system design concepts, the performance of design trades, selection and implementation of the best design, verification that the design is properly built and integrated, and post-implementation assessment of how well the system meets the goals.

List of Experiments:
1. Method Study Experiments
2. Work Measurement Experiments
3. Physiological Evaluation Tests
4. Eye-Hand Coordination Experiments
5. Construction of Control Charts for Quality Control and Analysis
6. Acceptance sampling

Course Outcomes:
After going through this course the student will be able to:
- Apply the method study guidelines in the analysis and redesigning of processes. Model work systems using standard tools for purposes of work system documentation, analysis, and design. **[L-3]**
- determine the time required to do a job using the concepts of work measurement. **[L-5]**
- demonstrate documentation and presentation skills pertinent to Work Systems design. **[L-3]**
- construct control charts for variables and attributes to monitor and stabilize the processes **[L-3]**
- design acceptance sampling procedures to economically arrive at an acceptable level of quality **[L-6]**

19EMC741: RESEARCH METHODOLOGY AND IPR

                                                                    L   T   P   C
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This course introduces the student, to the fundamentals of research,
research process, technical writing and intellectual property rights. Students will be able
to use this knowledge to gain interest in their subject area and pursue their career in
research.

Course Objectives
- ➢ To familiarize the meaning, objectives and sources of research
- ➢ To acquaint the student with the importance and methods of literature review/research ethics
- ➢ To impart the knowledge of technical writing for preparing reports, presentations, research proposals, conference/journal publications
- ➢ To introduce the terminology and process of obtaining intellectual property rights
- ➢ To expose the intricacies in the process of obtaining patent rights

Unit I   **5L**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Learning Outcomes

After the completion of this unit, the student will be able to
- • define the meaning of a research problem
- • list the different sources of research problem
- • enumerate the different criteria of good research and list the different errors in selecting research problem
- • contrast the different approaches of research
- • compare the different methods for data collection and analysis

Unit II   **5L**

Effective literature studies approaches, analysis Plagiarism, Research ethics

Learning Outcomes

After the completion of this unit, the student will be able to
- • list and elaborate the different steps of the research process
- • explain the importance of carrying out an effective literature review
- • identify the research gaps from literature review
- • describe the ethical principles to be following during research process and authorship
- • define the terminology and list the methods to avoid being accused of plagiarism
- • list the different types of research misconduct

Unit III   **5L**

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Learning Outcomes

After the completion of this unit, the student will be able to
- • list the attributes, reasons and guidelines for effective technical writing
- • contrast between conference paper, technical presentation and journal paper
- • choose a particular research contribution for patenting or journal publication
- • define the terminology related to citation, citation index, h-index etc

Unit IV   **5L**
Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. **International Scenario**: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the codes and standards in building intellectual property rights
- list the subject, importance and requirements for of patentability
- explain the process of patenting and commercialization in academia
- enumerate the procedure for application preparation, filing and grant of Patents
- define the terminology related to citation, citation index, h-index etc

Unit V   **8L**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. **New Developments in IPR**: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.
Learning Outcomes
After the completion of this unit, the student will be able to
- explain the scope of patent rights
- describe the process for licensing and transfer of technology
- identify the sources of patent information and databases
- elaborate the administration of patent system
- describe the new developments in IPR in computer software, biological systems etc

Text Book(s):
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for Science and engineering students", Tata Mcgraw Hill India, 2013.
2. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", 2/e, Prentice Hall of India, 2013.

References:
1. Halbert, "Resisting Intellectual Property", Taylor and Francis Limited, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand Publishers, 2008

Course Outcomes:
After successful completion of the course, the student will be able to
- define the meaning, sources, approaches for research problems
- explain the guidelines for carrying out effective literature review and identify research gaps
- describe effective guidelines for preparing technical reports, research publications, presentations and research proposals
- describe the codes, standards and process of obtaining intellectual property rights
- enumerate the new developments of IPR in engineering systems

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The workspace is one of the main resources to deliver products/services with the expected level of quality with minimum cost. To achieve the organizational effectiveness and efficiency proper utilization of the workspace has to be ensured. This course has been designed to highlight the basic issues, concepts and the techniques related to Plant layout and assembly lines.

Course Objectives:
➢ Impart knowledge on plant layout and plant location Theories.
➢ Introduce and explain the concept of SLP procedure for plant layout preparation.
➢ Learn the basics of material handling techniques.
➢ Understand the line balancing techniques and labor optimization in industry.

Unit I 10L
Introduction: Types of manufacturing processes, Overview of Plant Design, Plant Location-Location Factors, Location Theory, Nature, Significance and Scope of Facilities Layout Planning.
Plant Layout: Need for Layout, Objectives, Types of Layout, Layout Design Process, Layout Design Cycle, Data Collection, Equipment Requirement, Activity Analysis, REL Diagram, Employee Requirement, Development of Layout - Block Plan, Selection, Specification, Evaluation.
Learning Outcomes:
After completing this unit, the student will be able to
  • familiarize the characteristics of the product, process layouts. **[L-1]**
  • expose various factors that influence the location of a plant in urban vs rural area. **[L-3]**
  • know different phases of layout planning. **[L-2]**
  • study a facility location problem for single and multiple facilities. **[L-2]**

Unit II 8L
Single Facility Location Problems: Rectilinear Distance Problems, Squared Euclidean Distance Problems and Euclidean Distance Problems, Contour Lines (Iso-Cost Lines).
Introduction to Multi facility Location Problems: Formulation of Problems, LP formulation with rectilinear distance.
Learning Outcomes:
After completing this unit, the student will be able to
  • study the material flows in the manufacturing industry. **[L-2]**
  • adapt the knowledge in REL chart. **[L-6]**
  • employ various computer algorithms in designing a layout. **[L-3]**
  • teach the students for selecting a layout process**. [L-3]**

Unit III 8L
Computerized Layout Planning: Basic Philosophy in Computerized Layout Planning, Construction and Improvement Algorithms, Major features of Improvement Algorithms. Major Features of Computerized Algorithms, such as ALDEP, CORELAP, CRAFT, FRAT, and MAT
Learning Outcomes:
After completing this unit, the student will be able to
  • enumerate some numerical problems for the selection of MH equipment for a given material. **[L-1]**

- Recognize the importance of layout planning through a case study. **[L-1]**

Unit IV   **8L**
Formulation of Layout Problems: Quantitative, Qualitative, and multi-objective, Limitation of Computerized Layout Planning, Flow Dominance, Complexity Rating, Solution Efficiency.
Learning Outcomes:
After completing this unit, the student will be able to
- familiarize various functions and principles of material handling systems. **[L-1]**
- introduce various MH equipment used in the manufacturing industry. **[L-1]**
- expose various materials used in the manufacturing industry. **[L-3]**

Unit V   **8L**
Mass Production Management (Line Balancing): Basic idea of assembly line balancing, Optimization of the number of stations with given production rate, Minimization of cycle time with a fixed number of stations. **Line Balancing Algorithms:** Kilbridge and Wester, Rank Positional Weight method, COMSOAL, Moodie and Young method.
Learning Outcomes:
After completing this unit, the student will be able to
- learn the concept of line balancing in an assembling product. **[L-1]**
- acquaint knowledge in a minimum number of work stations in a production line. **[L-1]**
- solve numerical problems in calculating the minimum cycle time of an assembly line.**[L-3]**
- evaluate the algorithmic approach to balance the assembly line. **[L-5]**
- explain various methods for assembly line balancing in mass production. **[L-2]**

Text Book(s):
1. R.L Francis and J.A White, Facilities layout and location-An analytical approach, Prentice Hall, 1999.
2. R.Paneerselvam, Production and operations management, 3/e, Prentice Hall Inc, 2012.
Reference Books:
1. J.M. Apple, Plant Layout and Material Handling, McGraw Hill, 1972.
2. P.Rama Murthy, Production and operations management, 2/e, New Age International, 2006.

Course Outcomes:
- able to evaluate and analyze ethics and value policies and application of theories. **[L-5]**
- understand standard policies and procedures applicable to value principles. **[L-2]**
- able to pick and choose the best ethical standards and concepts for a given problem. **[L-6]**
- analyze problems related to Brain storming technique and other feasibility approaches**[L-4]**

L T P C
3 0 0 3

This course gave the competitive business forces operating in the global arena, supply chain management form the backbone of any organization's operating structure. Flawless execution of agile supply chain strategies brings a company to the path of sustainable profitability. Due to ever-growing competition and decline in profit margin the organizations are forced to introspect and bring out individual excellence model reengineering their business processes. Hence, this course hovers over the basic functions of supply chain management across industries and the importance of supply chain integration to ensure profitability.

Course Objectives:
- ➢ Enumerate the major building blocks, functions, business processes, performance metrics and decisions (Strategic, tactical and operational) in Supply chain.
- ➢ Analyze the inventory management methodologies to improve the performance of the supply chain.
- ➢ Explore three fundamental design concepts: component commonality, modularity vs. integral design, and universality, and a cost/benefit framework.
- ➢ Compare various procurement strategies and Impact of technology on supply chain optimization in procurement strategy.
- ➢ Acquire knowledge of Risks and issues in Local and Global supply chains.

Unit I **8L**
Introduction to Supply Chain Management (SCM): Concept of supply management and SCM, Importance of supply chain flows, Core competency, Value chain, Elements of supply chain efficiency, Key issues in SCM, Decision phases, Supply chain integration, Process view of a supply chain, Competitive Strategy and supply chain strategies, Uncertainties in supply chain, Supply chain drivers.
Learning Outcomes:
After completing this unit, the student will be able to
- recognize and analyze operations and supply chain management issues in a firm. **[L-2]**
- extend critical thinking skills in business situations. **[L-3]**
- analyze the manufacturing operations of a firm**[L-4]**
- apply logistics and purchasing concepts to improve supply chain operations**[L-3]**
- analyze the global business environment. **[L-4]**

Unit II **10L**
Inventory Management: Introduction, Selective control techniques, Cost involved in the inventory system, Single-stage inventory control, Economic lot size models, application to economic production quantity, Effect of demand uncertainty, Single period models, Initial inventory, Multiple order Oporto Units, Deterministic Models, Quantity discounts. Periodic and Quantity review policies, Mathematical modeling under known stock out costs and service levels, Joint replenishment for multiple items, Inventory system constraints, Working capital restrictions, and storage space restrictions.
Learning Outcomes:
After completing this unit, the student will be able to
- describe a system to keep track of inventory**[L-2]**
- classify systems of Effective Inventory Management**[L-2]**
- analyze the satisfactory levels of customer service while keeping inventory costs within reasonable bounds. **[L-4]**

Unit III   **8L**

Designing Supply Chain Network: Introduction, Network design, factors influencing network design, Data collection, Data aggregation, Transportation rates, Warehouse costs, Capacities and locations, Models and data validation, Key features of a network configuration, Impact of uncertainty on network design, Network design in uncertain environment, Value of information: Bullwhip effect, Information sharing, Information and supply chain trade-offs, Distribution strategies, Direct shipment distribution strategies, transshipment and selecting appropriate strategies.

Learning Outcomes:

After completing this unit, the student will be able to

- identify the supply chain management in all its diverse aspects and its applicability **[L-2]**
- develop comprehensive strategic and tactical plans for an organization**[L-6]**
- recognize how supply chain design facilitates network integration**[L-2]**
- apply the main network design and implementation steps. **[L-3]**
- identify the factors that are to be taken into account during network design and in locating facilities. **[L-1]**

Unit IV   **8L**

Supply Chain Integration: Introduction, Push, Pull and Push-pull supply chains, identifying appropriate supply chain strategy, sourcing and procurement, Outsourcing benefits, Importance of suppliers, evaluating a potential supplier, Supply contracts, Competitive bidding, and Negotiation. Purchasing, Objectives of purchasing, Relations with other departments, Centralized and Decentralized purchasing, Purchasing procedure, Types of orders, Tender buying, E-procurement, Role of E-business in supply chains.

Learning Outcomes:

After completing this unit, the student will be able to

- identify the components of an integrated logistics management system. **[L-1]**
- identify the decisions involved in transportation management. **[L-1]**
- develop different alternatives and get a solution to be implemented. **[L-6]**
- analyze suitable methodologies to design a solution for an LSM problem. **[L-4]**

Unit V   **8L**

Issues in Supply Chain Management: Introduction, Risk management, Managing global risk, Issues in the international supply chain, regional differences in logistics. Local issues in the supply chain, issues in a natural disaster and other calamities, issues form SMEs, Organized retail in India, Reverse logistics.

Learning Outcomes:

After completing this unit, the student will be able to

- describe fundamental issues in supply chain management. **[L-2]**
- apply knowledge to evaluate and manage an effective supply chain by minimizing the risk factors. **[L-3]**
- justify aligning the management of a supply chain with corporate goals and strategies. **[L-2]**
- analyze the issues and search for methodologies to improve supply chain processes. **[L-4]**

Text Book(s):

1. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, Ravi Shankar. Designing & Managing the Supply Chain: Concepts, Strategies & Case Studies, 3/e, Tata McGraw-Hill, 2007.
2. S. Chopra, P. Meindl, Supply Chain Management: Strategy, Planning & Operations,

1/e, Pearson India, 2012.

References:

1. Janet Shah, Supply Chain Management: Text and Cases, 1/e, Prentice Hall Ltd., 2009.
2. R.J. Tersine, Principles of Inventory & Materials Management, 4/e, Pearson, 1993.

Course Outcomes:

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

- identify strategic and operational frameworks to analyze supply chains. **[L-4]**
- design a supply chain network. **[L-6]**
- describe inventory control models and develop inventory control systems under deterministic and constrained scenarios **[L-2]**
- develop inventory control systems under probabilistic scenarios**[L-6]**
- develop a detailed knowledge of the inventory management in improving the performance of the supply chain. **[L-6]**
- outline different collaboration method in supply chain performance enhancement**[L-2]**

19EIE742: OPTIMIZATION TECHNIQUES

L T P C
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This course exposes the evaluation of the best possible solution for various engineering planning and design problems. The aim of the course is to train the students to develop a mathematical model and to solve the model by applying an appropriate mathematical programming technique. This course covers all advanced optimization techniques like geometric, dynamic, integer, stochastic and unconventional optimization techniques.

Course Objectives:
➢ To illustrate the importance of advanced optimization techniques in theory and practice.
➢ To formulate and solve engineering design problems in the industry for optimal results
➢ To test the analytical skills in solving real engineering problems by applying appropriate optimization technique.
➢ To demonstrate various advanced and unconventional optimization techniques being developed in recent times.
➢ To develop and promote research interest in problems of Engineering and Technology

Unit I   8L
Geometric programming (G.P): Unconstrained minimization problem, Solution of an unconstrained geometric programming, differential calculus method and arithmetic method, Primal-dual relationship and sufficiency conditions. The solution of a constrained geometric programming problem (G.P.P), Complementary Geometric Programming, constrained minimization.
Learning Outcomes:
At the end of this Unit, the student will be able to
   • formulate the geometric programming problem [**L-3**]
   • evaluate the optimal solution to the geometric programming problem[**L-4**]

Unit II   8L
Dynamic programming (D.P): Multistage decision processes, Concepts of sub-optimization, a computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P and Continuous D.P.
Learning Outcomes:
At the end of this Unit, the student will be able to
   • formulate the given linear/non-linear programming problem as a dynamic programming problem[**L-3**]
   • evaluate the optimal solution to dynamic programming problems using multi-stage decision process [**L-4**]

Unit III   9L
Integer programming (I.P): Integer linear programming, Graphical representation, Gomory's cutting plane method, Bala's algorithm for zero-one programming problem, Integer nonlinear programming, Branch-and-bound method, sequential linear discrete programming, generalized penalty function method
Learning Outcomes:
At the end of this Unit, the student will be able to
   • formulate the integer and/or binary programming problem [**L-3**]
   • evaluate the optimal solution to integer and/or binary programming problem [**L-4**]

Unit IV   **8L**

Stochastic Programming (S.P): Basic concepts of Probability Theory, Stochastic linear programming, stochastic non-linear programming.

Learning Outcomes:

At the end of this Unit, the student will be able to
- define random variables and formulate the stochastic programming problem [**L-1 &L-3**]
- analyze the optimal solution to a given problem under uncertainty [**L-4**]

Unit V   **9L**

Unconventional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated Annealing, Neural Networks based Optimization.

Learning Outcomes:

At the end of this Unit, the student will be able to
- formulate the multi-variable optimization problem [**L-3**]
- evaluate the optimal solution to the multi-variable optimization problem [**L-4**]

Text Book(s):
1. Rao S.S., Engineering Optimization - Theory and Practice, 3/e, New Age International (P) Ltd. Publishers, 1996.

References:
1. Ravindran, Phillips and Solberg, Operations Research- Principles and Practice, 2/e, John Wiley, 2007.
2. Hiller and Lieberman, Introduction to Operations Research, 7/e, McGraw Hill, 2002.
3. James P. Ignizio, Goal Programming, and Extensions, 2/e, Lexington Books, 1976.
4. David E. Goldberg, Genetic Algorithms - In Search, Optimization and Machine Learning, 1/e, Addison-Wesley Longman (Singapore) Pvt. Ltd., 1989.

Course Outcomes:

After the successful completion of this course, the students will be able to
- formulate and solve geometric programming problems (**L-4&L-3**)
- solve any complex optimization problem as a dynamic programming problem and analyze its solution (**L-3&-L4**)
- recognize the significance of integer and/or binary solutions and apply a suitable algorithm for better decision making (**L-1&L-3**)
- formulate and solve stochastic optimization problems for decision making under uncertainty (**L-4&L-3**)
- formulate and solve multi-objective optimization problems; to propose various modern unconventional optimization techniques. (**L-4&L-3**)

19EIE744: PRODUCT DESIGN AND DEVELOPMENT

L T P C
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This course is to give an introduction to the multidisciplinary aspects of product development and innovation. Students will familiarize themselves with basic methodology and tools that can be used in product development projects. Practical problems will be considered in cooperation with companies in order to simulate real product development situations.

Course Objectives:
  ➢ Study the basic concepts of product design and development process.
  ➢ Study the applicability of product design and development in industrial applications
  ➢ Expose the students to the material aspects of Product design
  ➢ Highlight the importance of creativity for new product development
  ➢ Study skills needed for enhancing creative thinking and encouraging innovation
  ➢ Importance of various principles of quality in a product or service through.

Unit I   **8L**
Introduction to Product Design: Definition of product design, design by evolution and Innovation, essential factors of product design, Morphology of design, primary design phases and flowcharting.
Product Design Practice and Industry: Introduction to Product Strategies, Time to Market, Analysis of the Product, the Designer, and his Role. The procedure adopted by Industrial Designers, Types of Models designed by Industrial Designers, Role of Aesthetics in Product Design, Functional Design Practice.
Learning Outcomes:
After completing this unit, the student will be able to
  • select an appropriate product design and development process for a given application**[L-6]**
  • develop the methods to minimize the cost. **[L-6]**
  • understand the marketing strategies for a new product or existing product**[L-2]**

Unit II   **10 L**
Design for Production: Metal Parts: Producibility Requirements in the Design of machine components, and Other Methods of Manufacturing. Design for machining ease, the role of process engineer.
Material Processing of Plastics, Rubber, Glass and Ceramics: Manufacturing and Processing Methods for Plastics Ceramics Glass and Rubber, Approach to Design with Plastics, Plastic Bush Bearings, Design recommendations for Rubber Parts, Production Design Factors for Ceramic Parts, Special Considerations for Design of Glass Parts.
Learning Outcomes:
After completing this unit, the student will be able to
  • choose an appropriate ergonomic for the product. **[L-5]**
  • select an appropriate standardization method**. [L-6]**
  • select pricing for products and services**[L-6]**

Unit III   **8L**
Human Engineering Considerations in Product Design: Introduction, Human being as applicator of force, the design of controls, the design of displays, Man/Machine Information Exchange, Work Place layout from Ergonomic considerations, Noise, Heating

and Ventilating, Lighting.

Value Engineering and Product Design: The Value analysis Job Plan, Creativity, Blocks to creativity, Factors Conducive to Creativity, Creative Techniques, Steps to Problem Solving and Value analysis, Value analysis Tests.

Learning Outcomes:

After completing this unit, the student will be able to

- understand the various techniques adopted for stimulating creativity**[L-2]**
- apply innovative process to the design and development of new products**[L-3]**
- choose appropriate marketing analysis tools**[L-5]**

Unit IV   **8L**

Role of Computer in Product Design, Manufacturing and Management: Product Cycle and CAD/CAM, Role of Computer in Manufacturing and design process, Creation of a Manufacturing Database.

Computer Integrated Manufacturing: Group Technology, Production Flow Analysis (PFA), Computer Aided Process Planning (CAPP), Material Requirement Planning (MRP), Artificial Intelligence, Flexible Manufacturing Systems and Just-In-Time (JIT) Manufacturing.

Learning Outcomes:

After completing this unit, the student will be able to

- apply design concepts for manufacturing, assembly and environment**[L-3]**
- choose material to design vehicle parts**[L-5]**
- understand consumer behavior and need for product development**[L-2]**

Unit V   **8L**

Quality Assurance in Product Design and Manufacturing: Evolution of Quality Concepts and Applications, Theory of Sampling Inspection, Control Charts and In-process Monitoring of Quality, Quality of Performance.

New Product Development and Product Management: Defining Product by Nature of Demand, New Product Strategy, Product Classification, Product Development, and Product Management, New Product Development, Models Utilized in various Phases of new Product Development.

Learning Outcomes:

After completing this unit, the student will be able to

- understand concepts in quality and reliability principles in the design of an engineering product or a service**[L-2]**
- strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product. **[L-3]**

Text Book(s):

1.   A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 4/e, PHI, 2007.

References:

1. Karl T.Ulrich and Steven D.Eppinger, Product Design and Development, 3/e, Mc Graw Hill, 2003**.**

Course Outcomes:

At the end of the course the students should be able to:

- able to understand the technical and business aspects of the product development process **[L-2]**
- skilled in the implementation of gathering data from customers and establish technical specification **[L-1]**
- able to understand product functional decomposition **[L-2]**

- able to participate in engineering problem solving **[L-1]**
- able to understand the principles behind product modularization, to be able to understand intellectual property issues in product development **[L-2]**
- able to understand ethical issues in product development**[L-2]**

19EIE746: MARKETING MANAGEMENT

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This Course provides the importance of marketing as the interface between the organization and the consumer and its potential to generate revenue. The course introduces basic concepts of marketing like buying behavior, product planning and pricing, distribution channel, segmentation, targeting, positioning, etc. and how marketers use them to make marketing plans.

Course Objectives:
- Understand the basic concepts of marketing.
- know the buyer attitude towards decision making and the factors affecting the decision-making process
- Understand product, it's branding and pricing concepts.
- Understand various distribution channel and the basics of advertising and sales promotion.
- Understand the basic fundamentals underlying of CRM, services, rural, digital and international marketing

Unit I   **10L**
Introduction to Marketing: Marketing defined, Marketing Concepts, Marketing functions, Marketing Environment. **Marketing Planning:** Planning Process, Strategic Business Units, **Market Segmentation, and Market Targeting:** Segmentation Procedure, Market Targeting, Product Positioning.
Learning Outcomes:
After completing this unit, the student will be able to
- state the role and functions of marketing within a range of organizations. **[L-1]**
- describe key marketing concepts, theories, and techniques for analyzing a variety of marketing situations. **[L-1]**

Unit II   **8L**
Marketing Mix: Marketing mix variables and their importance. **Pricing Strategies:** Meaning of pricing, Importance, Objectives, Factors influencing price determination, Demand market-based pricing, tender pricing, Product line pricing, selecting the final price.
Learning Outcomes:
After completing this unit, the student will be able to
- apply the introduced conceptual frameworks, theory and techniques to various marketing contexts. **[L-3]**
- analyze the relevance of marketing concepts and theories in evaluating the impacts of environmental changes on marketing planning, strategies, and practices. **[L-4]**

Unit III   **8L**
Marketing Research: Marketing Research Process, Research objectives, Research Plan development, Collecting information Analysis.
Consumer Behaviour: Factors influencing Consumer Behaviour, Decision-making process in buying, perceived risks.
Creating customer value, Satisfaction, and loyalty: Building customer value, satisfaction, and loyalty, Customer perceived value, Total customer satisfaction, Measuring satisfaction,
Learning Outcomes:
After completing this unit, the student will be able to

- demonstrate the ability to carry out a research project that explores marketing planning and strategies for a specific marketing situation. **[L-2]**
- demonstrate the ability to justify marketing strategies and advocate a strategically informed position when considering marketing plan implementation. **[L-2]**

Unit IV   **8L**
Product Development: Idea generation, Concept development, and Testing, Market Testing, Commercialization. **Marketing Communication:** Marketing mix variables communicate, Steps in developing effective communication.
Learning Outcomes:
After completing this unit, the student will be able to
- evaluate the viability of marketing a product or service in an international market or markets. **[L-5]**
- evaluate the results of marketing activities using criteria related to budgeted sales, costs and profits. **[L-5]**

Unit V   **8L**
Creating brand equity: What is brand equity? The role of brands, The scope of branding, **Advertising Management**: Purpose, Factors in advertising, Advertising Portfolio Selection, **Sales Promotion:** Sales Promotion Tools, Consumer promotion tools, Business promotion tolls.
Learning Outcomes:
After completing this unit, the student will be able to
- apply the principles of business ethics and corporate social responsibility**[L-3]**
- apply digital tools to analyze the effectiveness of a marketing campaign. **[L-3]**

Text Book(s)
1. P.Kotler, Marketing Management - Analysis, Planning, Implementation and Control, Prentice-Hall of India, New Delhi, 2001.

References:
1. V.S.Ramaswamy, S.Namkumari, Marketing Management - Planning, Implementation and Control, Macmillan India Limited, 1990.
2. R.Majumdar, Marketing Research - Text, Applications and Case Studies, Majumdar, R. New Age International Publishers, 1996.
3. W.J Stanton, M.J Etzeland, B.J Walker, Fundamentals of Marketing, McGraw-Hill, 1991.

Course Outcomes:
- understand and apply information from the liberal arts, sciences, business and discipline-specific courses to organized issues and situations. **[L-2]**
- explain how ethical, legal, political, regulatory, social, global, environmental and technological issues influence business decisions. **[L-1]**
- analyze a business problem by incorporating diverse perspectives. **[L-4]**
- apply foundation business knowledge and skills to develop competent decisions in the areas of accounting, economics, finance, information systems, management, and marketing. **[L-3]**
- communicate effectively the alternatives considered, a recommended solution, and an implementation strategy in oral, written and electronic form. **[L-1]**

19EIE748: INDUSTRIAL SCHEDULING

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The purpose of the course is to introduce students to a broad range of scheduling problems that arise in both manufacturing and service organizations, and to teach scheduling techniques, starting from basic principles, and leading to algorithms and computerized scheduling systems. The topics include machine scheduling and job shop scheduling, flexible assembly systems, interval scheduling, and workforce scheduling. The emphasis will be on systems design and implementation.

Course Objectives:
➢ objective is to expose participants to basic scheduling theory results, and in a participatory setting, enable them to discuss and creatively synthesize these ideas to research projects of choice.
➢ It blends quantitative and qualitative material, from multiple disciplines of industrial and management engineering.
➢ The course will be conducted in a beneficial cooperative learning setting. Lectures, group discussions, research projects and participant presentations will constitute this course.

Unit I   **10L**
Introduction: Importance of scheduling in implementation of production planning, overview of models, machine configurations, processing characteristics and constraints, objectives and performance measures, computational complexity; NP complete and NP hard, optimality of schedules
Learning Outcomes:
After completing this unit, the student will be able to
• identify planning and scheduling objectives and requirements in manufacturing**[L-1]**
• develop and analyze operations performance measurements and analysis for continuous improvement.**[L-3]**

Unit II   **8L**
Single machine sequencing with independent jobs, without due dates, with due dates, adjacent pair wise interchange methods, branch and bound approach, neighborhood search techniques, random sampling, parallel machine models.
Learning Outcomes:
After completing this unit, the student will be able to
• apply planning and scheduling techniques in different application domains**[L-3]**
• identify, formulate and solve Industrial Engineering-related problems by using state-of-the-art methods, techniques and equipments**[L-1]**

Unit III   **8L**
Flow shop scheduling: Introduction, permutation schedules, Johnson's problem-Ignall and Schrage algorithm, dominance properties for make span problems, CDS, Palmer, Gupta heuristics, Scheduling in process industries with no waiting or work in process.
Learning Outcomes:
After completing this unit, the student will be able to
• use scheduling as a control mechanism**[L-3]**
• analyze forecasting models to develop business enterprise forecasts for product demand, profits, sales, material requirements, capacity requirements, etc**[L-4]**

Unit IV   **8L**

Job shop scheduling Introduction, types of schedules, schedule generator, Disjunctive Programming and Branch and bound, shifting bottleneck heuristic and the make span, simulation studies, elements of dynamic job shop, Scheduling in dynamic flow systems, use of priority disciplines.

Learning Outcomes:

After completing this unit, the student will be able to

- outline the state-of-the-art in the scientific literature on planning and scheduling in defined areas**[L-4]**
- classify the applications of scheduling models**[L-4]**

Unit V   **8L**

Applications and directions: Scheduling of Flexible assembly systems, lot sizing and scheduling -Scheduling balancing and other aspects of design in mixed model assembly lines and flow lines, A survey of other scheduling problems, Applications in manufacturing systems.

Learning Outcomes:

After completing this unit, the student will be able to

- develop planning and scheduling approaches for real-life problems in manufacturing and services**[L-6]**
- develop and analyze the capacity planning process**[L-6]**
- identify characteristics and relationship to business operations in regard to managing product demand versus product capacity**[L-1]**

Text Book(s):

1. Michael Pinedo and Xiuli Chao, Operations Scheduling: With application in Manufacturing and Services, McGraw Hill, 1993.

References:

1. Kenneth R.Baker, Introduction to sequencing and scheduling, John Wiley and Sons. 1974.
2. R.W. Conway, W.L. Maxwell and L.W.Miller, Theory of Scheduling, Addison, Wesley. 1967.
3. Michael Pinedo Scheduling: theory, algorithms and systems, Prentice Hall, New Delhi,1995.
4. S. French Sequencing and Scheduling, Elis Horwood Ltd., Chichester, U.K. 1982

Course Outcomes:

A student who has met the objectives of the course will be able to:

- identify the role and impact of planning and scheduling**[L-2]**
- correlate planning and scheduling to the functions in an enterprise**[L-4]**
- outline planning and scheduling objectives and requirements in services**[L-4]**
- recognize key planning and scheduling concepts**[L-2]**

19EIE752: MANAGEMENT OF TECHNOLOGY AND INNOVATION

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In this course, you will examine the interface between innovation, technology, entrepreneurship and commercialization from an interdisciplinary perspective linking engineering, science, business, and management. Through case studies and selected readings, you will develop new insights to facilitate evidence-based decision making involving the integration of technology strategy with business strategy in technical services and engineering/technology-based organizations.

Course Objectives:
- ➤ Develop an understanding of analytic frameworks for managing the innovation process
- ➤ Examine the patterns and sources of technological change and the mechanisms for capturing the economic benefits from innovation
- ➤ Identify the strategic and organizational challenges involved in managing technological innovation
- ➤ Develop an ability to design innovative strategies that can successfully take advantage of innovation opportunities
- ➤ Evaluate different options, formulate and develop a strategy and assess and resolve managerial challenges.

Unit I   **10L**
Understanding Management of Technology: Key concepts, importance, issues. Technology development and society, Technology and Corporate growth, Technology forecasting, Technology innovation and applied research, Technology transfer- Process of technological change, Innovation technology evaluation, Adoption, and diffusion.
Learning Outcomes:
After completing this unit, the student will be able to
- • definitions and concepts of invention, design, research, technological development and innovation **[L-1]**
- • assess and interpret innovation processes**[L-5]**

Unit II   **8L**
Technology and competition: Technology acquisition, Integration of strategic planning and technology planning. Key performance factors for technology management.
Learning Outcomes:
After completing this unit, the student will be able to
 managerial strategies to shape innovative performance **[L-1]**
- • tools of innovation management to map and measure innovative activities**[L-1]**
- • utilize tools of innovation management to map and measure innovative activities**[L-5]**

Unit III   **8L**
Technology Strategy: Technology intelligence collaborative mode, Appropriation of technology, Deployment in new products, simultaneous engineering, Development in the value chain.
Learning Outcomes:
After completing this unit, the student will be able to
- • stimulate and inform a strategic perspective on the role of innovation. **[L-1]**

- characteristics of innovation processes and the factors that shape and drive innovation**[L-1]**
- develop and formulate managerial strategies to shape innovative performance**[L-6]**

Unit IV   **8L**
Technology evaluation and financing Evaluation of R & D projects: Budgeting and cost control changing the role of R & D.
Learning Outcomes:
After completing this unit, the student will be able to
- diagnosis and effective solutions to innovation challenges**[L-2]**
- diagnose different innovation challenges and make recommendations for resolving them**[L-2]**

Unit V   **8L**
Management of Manufacturing technology Product development, Market development, corporate cultures, technology audits.
Learning Outcomes:
After completing this unit, the student will be able to
- understand the sources of innovation competence in firms and how these competencies are developed**[L-2]**
- potential roles of incremental and disruptive innovation in creating and sustaining firm competitiveness**[L-1]**

Text Book(s):
1. D.L Babcock, Managing Engineering Technology,3/e, PHI, 2008
2. S.W Wright, C. Christensen, R. Burgelman, Strategic Management of Technology and Innovation, 4/e, Tata McGraw Hill, 2009
References:
1. David I. Cleland, K. Bursic, Strategic Technology Management, Amacom, 1992
2. V.K. Narayanan, Managing Technology and Innovation for Competitive Advantage, 1/e, Prentice Hall, 2000
3. M.Dodgson, The Management of Technological Innovation: Strategy and Practice, 2/e, Oxford University Press, 2012

Course Outcomes:
After studying this course, you should be able to:
- understand the issues around defining 'technology', 'innovation' and 'innovation management'**[L-2]**
- recognize the diversity of types of innovation, innovators and innovation settings**[L-1]**
- understand the nature and extent of technological change and innovation**[L-2]**
- critically assess and explain key current issues in our understanding of innovation as a field of study. **[L-3]**

This course focuses on particularly useful for practicing professionals who manage, plan, execute or sponsor construction, R&D, IT, facilities up gradation or Six Sigma projects. Some prior experience in having managed or acted as a resource in projects would be most helpful. If you are planning to learn about project management with the desire to write the PMP/PMI test, you will learn all the basics in this course.

Course Objectives:
- Introduction to the basic processes of project management for instructional design projects.
- Students will be introduced to organizational issues, methods of planning, and techniques for managing the business and creative processes that determine the success of a project.
- Students will learn to use project management software for organizing, scheduling and monitoring project progress.

Unit I   **8L**

Project Planning: Analysis and Appraisal Generation of project ideas, scouting for project ideas, Preliminary screening, Project rating index, Cost of project. Investment Appraisal: Social cost benefit analysis, UNIDO approach, Net benefit in terms of economic prices, Measurement of impact on distribution, Savings impact and its value, Income distribution impact, Adjustment for merit and demerit, Goods Little Mirrless approach, Shadow prices, Financial appraisal of Projects using MS Excel. Case studies on UNIDO approach.

Learning Outcomes:

After completing this unit, the student will be able to
- review the role of Project Management in instructional technology and project development **[L-2]**
- apply theoretical aspects and approaches to managing technology based projects **[L-3]**
- recognize the importance of Social cost benefit analysis**[L-2]**
- interpret the usage of Social cost benefit analysis, UNIDO approach**[L-2]**

Unit II   **10L**

Project Implementation: Development of project network, Dummy activities, Activity on node networks, Cyclic network, Forward pass and backward pass computations, Algorithm for critical path, Total slacks, free slacks and their interpretations. Work Breakdown Structure (WBS) concepts Time-cost Trade off Procedure: Schedule related project costs, Time cost trade off, lowest cost schedule. PERT Network: Three time estimates for activities, Estimation of mean and variance of activity times, Event oriented algorithm for critical path, Probability of meeting a schedule date.

Learning Outcomes:

After completing this unit, the student will be able to
- relate major stakeholders and organizational dynamics in a projects life cycle **[L-1]**
- identify potential factors that impact successful project management including scope creep, budgeting, team dynamics and working with overseas development vendors**[L-2]**
- extend knowledge and skills to create a formal project planning document **[L-3]**

Unit III 8L

Network Analysis: Algorithms for shortest route problems-Dijkstra's, Floyd's, and Dantzig's algorithms; Algorithms for minimal spanning tree- Kruskal's algorithm and Prim's algorithm; Algorithms for maximal flow problems. Maximum flow minimum cut explanation.

Learning Outcomes:

After completing this unit, the student will be able to

- recognize the importance of evaluating emerging technology in technology project management[**L-2**]
- practice algorithms and uses them in real time environments[**L-3**]

Unit IV 8L

Linear Programming Formulation of Network Problems: A flow network interpretation for determination of critical paths, Chance constrained linear programming for probabilistic durations of activities in PERT network. Project management with case studies using MS Projects and Primavera

Learning Outcomes:

After completing this unit, the student will be able to

- ➢ employ theoretical aspects and approaches to managing technology based projects in network problems[**L-3**]
- ➢ practice linear programming problems and uses them in real time environments[**L-6**]

Unit V 8L

Project Scheduling with Limited Resources: Optimizing the project schedule, Complexity of project scheduling with limited resources, leveling the demands on key resources, Resource Planning overview, Identifying resource requirements; a simple heuristic program for resource allocation.

Learning Outcomes:

After completing this unit, the student will be able to

- recognize the technical requirements of project management using MS Project[**L-2**]
- summarize projects specifics using Microsoft Project **[L-2]**
- connect knowledge and skills to create a formal scheduling project[**L-4**]

Text Book(s):

1. Parameshwar P. Iyer. Engineering Project Management with Case Studies, 1/e, Vikas Publishing House, 2005.
2. Prasanna Chandra, Projects Planning, Implementation and Control, 7/e, Tata McGraw Hill, 2009.

References:

1. Project Management Institute (PMI), A Guide to the Project Management of Knowledge Newton Square, 5/e, PA, 2013.
2. J.R. Meredith and S.J. Mantel. Project Management: A Managerial Approach 7/e, John Wiley and Sons, New York, 1995.
3. L.S. Srinath, PERT & CPM Principles & Applications, 3/e, East west Press, 2001

Course Outcomes:

- explain the project management principles and philosophy[**L-2**]
- comprehend the project environment through feasibility study[**L-2**]
- identify the investment opportunities and to formulate the projects.[**L-1**]
- appraise the development of project network-Time Estimation[**L-5**]
- outline the operation of projects under resource constrained environment and closing the projects[**L-2**]

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Human Resource Management helps the students in comprehending and evaluating the workforce at various cadres in an organization. The course will be delivered with the help of lectures accompanied by student interactions in the form of role-plays, situation analysis, presentations and decision-making activities such as case studies. The cases mentioned in the syllabus will be discussed in class for a better understanding of the topics.

Course Objectives
- Understand the basic concept of Human Resource Management and role played by HR Manager.
- Evaluate and Design various organizational structure and understand how they are related to organizational success
- Ability to form a policy for job analysis
- To know formalize, design and evaluate various recruitment and placement Policies.
- Summarize the purpose and process of employee orientation.
- List and briefly explain each of the four steps in the training process.

Unit I   **8L**

Introduction: Definition of personnel management, the concept of labor, organization, and function of the personnel department, personnel policies. Organizational objectives, functions, relationships, the organizational structure of formal and organizations, job design

Learning Outcomes:

After completing this unit, the student will be able to
- design the organization structure. **[L-6]**
- analyze the process of organizations and their aims **[L-4]**
- understand the basic concept of Human Resource Management. **[L-2]**
- validate various organizational structures and understand how they are related to organizational success. **[L-6]**

Unit II   **10L**

Manpower planning: Manpower forecasting, mobility and promotion problems, job analysis and job description. Selection: Developing sources, methods of recruitment, alternative selection policies, application blanks and qualification card, interviews, psychological test. Training: Types of training, requirements of effective training techniques, evaluating training effectiveness. Performance appraisal: performance appraisal systems and programs.

Learning Outcomes:

After completing this unit, the student will be able to
- list the steps in the recruitment and selection process. **[L-1]**
- list and discuss the main outside sources of candidates. **[L-1]**
- name and describe the main internal sources of candidates. **[L-1]**
- understand the importance of a diverse workforce and how to recruit it. **[L-2]**

Unit III   **8L**

Wage and Salary Administration: Factors affecting compensation policy, equity and compensation, comparable value, job evaluation, job evaluating systems simple ranking, job grading, point systems,

factor comparison system, effects of job evaluation on human relations, Expectancy theory, and compensation, variable compensation, supplementary compensations.

Learning Outcomes:
After completing this unit, the student will be able to
- summarize the purpose and process of employee orientation. **[L-2]**
- list and briefly explain each of the four steps in the training process. **[L-1]**
- list and discuss the pros and cons of six appraisal methods. **[L-1]**

Unit IV   **8 L**
Human Factor Management: Human factors in management behavioral models, motivation, Maslow's hierarchy of needs theory, hygiene approach to motivation, expectancy theory, reinforcement theory Mc Cleland's needs theory, motivational techniques.

Learning Outcomes:
After completing this unit, the student will be able to
- Trace the methods to motivate trainees. **[L-2]**
- Predict how you would identify training requirements. **[L-5]**
- distinguish between problems which can be fixed with training and which cannot be. **[L-4]**

Unit V   **8L**
Leadership: Definition, trait approaches to leadership, leadership behavior and styles, situational approach to leadership. Communication and Counseling: Nature and importance of communications, channels, and structure, communication process, Management by objectives, counseling.

Learning Outcomes:
After completing this unit, the student will be able to
- use methods of collecting job analysis information, including interviews, questionnaires, and observation. **[L-3]**
- Describe job descriptions, including summaries and job functions, using the Internet and traditional methods. **[L-2]**
- Paraphrase job specifications using the Internet as well as your judgment. **[L-2]**

Text Book(s):
1. K. Aswathappa, Human Resource Management: Text and Cases, 7/e, McGraw Hill, 2013
2. H Koontz, H.Weihrich, Essentials of Management: An International and Leadership Perspective,9/e, McGraw Hill, 2012

References:
1. A. Monappa and M Saiyadain, Personnel Management, 2/e, McGraw Hill, 2001
2. George Strauss, Leonard R. Sayles Personnel: Human Problems of Management,4/e, Prentice Hall, 1980
3. E. B. Flippo, Personnel Management, 6/e, McGraw Hill, 1984.

Course Outcomes:
- interpret the basic concepts, functions, and processes of human resource management **[L-2]**
- Recognize the role, functions, and functioning of the human resource department of the organizations. **[L-2]**
- design and formulate various HRM processes such as Recruitment, Selection, Training, development, Performance appraisals, and Reward Systems, Compensation Plans and Ethical Behaviour. **[L-6]**

- Identify different ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy **[L-1]**
- evaluate the developing role of human resources in the global arena. **[L-5]**

19EIE758: FINANCIAL MANAGEMENT

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This course aims to familiarize the students with the skills related to basic principles, tools, and techniques of financial planning. These tools aid the firms to maximize value by improving decisions relating to working capital, cost of capital and capital structure and capital requirements of an organization.

Course Objectives:
- ➢ introduce the concept of financial management, with special emphasis placed on the development of a plan or strategy.
- ➢ estimate value the equity, operations, and debt of companies using different valuation approaches/models and financial statement information.
- ➢ analyze and reformulate financial statements to identify a firm's business strategy and value drivers so as to facilitate forecasting and valuation
- ➢ interpret the financial figures through various tools in the cost of capital.

Unit I   **8hours**
Introduction to financial management, Organization of the financial management functions, sources of finance, present value and future value concept to single, mixed and annuities simple problems
Learning Outcomes:
After completing this unit, the student will be able to
- explain the role of short-term financial management, and the key strategies and techniques used to manage cash, marketable securities, accounts receivable and inventory. **[L-4]**
- identify the major sources of short-term financing available to the firm. **[L-1]**
- calculate the future value and the present value of single sums, mixed streams, and annuities. **[L-3]**

Unit II   **10hours**
Valuation concepts, Bond valuation, Bonds with finite maturity, preferred stock valuation, Common stock valuation, Rates of return, Risk and return, Use of probability distributions to measure risk, Attitudes towards risk, Risk and return in a portfolio context, Diversification, Capital-Asset pricing model.
Learning Outcomes:
After completing this unit, the student will be able to
- estimate the value of bond and preference shares. **[L-1]**
- develop and employ theoretical valuation methods to price these financial instruments. **[L-6]**
- apply instruments in managing the risk of investing.**[L-3]**

Unit III   **8hours**
Financial Statements, Balance sheet ratios, Income statement, Trend analysis, Common size, and Index analysis. The flow of funds statement, Cash flows, forecasting, cash flow estimates, forecasting of financial statements.
Learning Outcomes:
After completing this unit, the student will be able to
- create and interpret financial statements. **[L-1]**
- create and interpret cash flow statements. **[L-1]**
- determine discount/hurdle rates. **[L-5]**

- evaluate investments in working capital and long-term assets**[L-5]**

Unit IV   **8hours**
Issues with working capital, financing current assets, combining liability structure and current asset decisions, Capital budgeting, Generating investment project proposals, Project evaluation, and selection difficulties, Project monitoring.
Learning Outcomes:
After completing this unit, the student will be able to
- interpret financial statements. **[L-1]**
- interpret cash flow statements. **[L-1]**
- determine discount/hurdle rates. **[L-5]**
- evaluate investments in working capital and long-term assets. **[L-5]**

Unit V   **8hours**
Intermediate and long-term financing, Private placement, initial financing, signaling effects, secondary market, bonds and their features, long term debt instruments, Term loans and leases, Provision of loan agreements, equipment financing, Lease financing, and its evaluation.
Learning Outcomes:
After completing this unit, the student will be able to
- explain and define the nature of the financial services industry with respect to providing personal financial planning services and compare those services with those provided by professional planners.**[L-1]**
- evaluate the trends that make financial planning an emerging profession. **[L-5]**
- evaluate a client's psychological attitudes so that a plan can be implemented that is acceptable to the clients. **[L-5]**

Text Book(s):
1. I M Pandey, Financial Management, Vikas, 10/e, 2010.
2. J.C.Van Horne, J M. Wachowicz, Fundamentals of Financial Management, Pearson Education Asia, 2002.
References:
1. Van Horne, Financial Management and policy, 12/e, Prentice Hall of India, 2002.
2. B really and Myers, Principles of Corporate finance, 7/e, Tata McGraw Hill, 2002
3. Ross, Westerfield and Jordan, Fundamentals of Corporate finance, 6/e, Tata McGraw Hill, 2002.
4. Damodaran, Corporate Finance, John Wiley & Sons, 2002.

Course Outcomes:
After completing this unit, the student will be able to
- apply and estimate the time value of money. **[L-2]**
- plan for the financial requirements of the company by analyzing the fund's flow and cash flow statements. **[L-1]**
- apply the concepts and techniques of working capital to determine the working capital requirements of an organization and also can able to evaluate the risk and return trade-off using advanced techniques. **[L-3]**
- analyze and interpret the financial figures through various tools in cost of capital **[L-4]**

19EOE742: BUSINESS ANALYTICS

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This course introduces students to the science of business analytics. The goal is to provide students with the foundation needed to apply data analytics to real-world challenges they confront daily in their professional lives. Students will learn to identify the ideal analytic tool for their specific needs; understand valid and reliable ways to collect, analyze, and visualize data; and utilize data in decision making for managing agencies, organizations or clients in their workspace

Course Objectives
- To familiarize the scope, process and advantages of business analytics
- To acquaint the student with the modeling and problem solving skills in business analytics
- To impart the organization and management of business analytics
- To introduce the forecasting models and techniques used in analytics
- To expose the formulation and decision strategies used in business analytics

Unit I   8L
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview

Learning Outcomes
After the completion of this unit, the student will be able to
- define the scope and process of business analytics **[L-1]**
- choose an organizational structure to implement a business analytics process **[L-3]**
- describe the statistical tools and methods used for data modeling and analysis **[L-2]**
- identify the sampling and estimation requirements for data analysis **[L-1]**

Unit II   8L
Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Learning Outcomes
After the completion of this unit, the student will be able to
- identify the relationships and trends in data **[L-1]**
- utilize linear regression methods for identifying data relationships **[L-4]**
- list the types of data and their models used for business analytics **[L-1]**
- describe the methods for visualization and exploration of data **[L-2]**

Unit III   8L
Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling,

Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Learning Outcomes

After the completion of this unit, the student will be able to
- describe the management issues in the organization structures **[L-2]**
- define the designing information policy and its usage **[L-1]**
- list the methods for ensuring data quality measuring contribution **[L-1]**
- explain the use of data mining methodologies for predictive analytics analysis **[L-3]**
- describe the use of prescriptive analytics methods in business analytics process **[L-2]**

Unit IV   **10L**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Learning Outcomes

After the completion of this unit, the student will be able to
- classify and describe the use of forecasting models **[L-3]**
- model the use of regression forecasting with casual variables **[L-5]**
- identify the appropriate forecasting model for a given data **[L-5]**
- explain the use of monte carlo simulation for forecasting and identify the involved risk **[L-2]**

Unit V   **8L**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Learning Outcomes

After the completion of this unit, the student will be able to
- formulate decision problems **[L-2]**
- list the decision strategies with and without probabilities **[L-1]**
- use the decision trees for analysis **[L-4]**
- describe the value of information, utility and its use in decision making **[L-4]**

Textbook(s):
1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications Pearson FT Press, 2014.
2. James Evans, Business Analytics, Pearson Education, 2013.

Course Outcomes:

Upon successful completion of the course, the student will be able to
- define the scope, process and advantages of business analytics **[L-1]**
- explain the modeling and problem solving skills in business analytics **[L-2]**
- describe the organization and management of business analytics **[L-3]**
- utilize the forecasting models and techniques used in analytics **[L-4]**
- enumerate and utilize the formulation and decision strategies **[L-2]**

19EOE744: INDUSTRIAL SAFETY

L T P C
3 0 0 3

Safety by design or prevention through design is in the core for maintaining engineering systems safe. The students will be equipped with concepts of engineering systems safety, dimensions of engineering systems safety, safety design and analysis mathematics, design for engineering systems safety and control for safety, and integrating safety with other operational goals such as quality and reliability

Course Objectives:
- to impart knowledge on different facets and aspects of industrial systems safety
- to familiarize the student with tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings
- to impart the knowledge of definition, function and types of maintenance activities
- to familiarize the different wear and corrosion mechanisms and their prevention methods
- to expose the students to different faults and their tracing mechanisms
- to impart the art of planning periodic and preventive maintenance mechanisms

Unit I   **8L**
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.
Learning Outcomes
After the completion of this unit, the student will be able to
- list the different types of mechanical and electrical hazards in industrial systems**[L-1]**
- enumerate the salient points of factories act 1948**[L-2]**
- describe the health and safety measures to be enforced for industrial safety**[L-3]**
- elaborate the different fire prevention and firefighting arrangements to be made**[L-2]**

Unit II   **8L**
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.
Learning Outcomes
After the completion of this unit, the student will be able to
- define the meaning and aim of maintenance engineering**[L-1]**
- elaborate the primary and secondary functions of maintenance department**[L-2]**
- classify the different types and applications of maintenance**[L-3]**
- relate the replacement economy with maintenance cost**[L-5]**
- estimate the service life of equipment from the specifications of individual components**[L-4]**

Unit III   **8L**
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick

feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Learning Outcomes

After the completion of this unit, the student will be able to
- explain the different types, causes and effects of Wear**[L-2]**
- elaborate the different methods for reducing wear**[L-2]**
- list the different types of lubricants and mention their applications**[L-1]**
- define the principle and factors affecting corrosion**[L-1]**
- classify the different types of corrosion and identify their prevention methods**[L-3]**

Unit IV   **8L**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

Learning Outcomes

After the completion of this unit, the student will be able to
- explain the different types, causes and effects of Wear**[L-2]**
- use the concept of decision tree for fault tracing in machine tools**[L-4]**
- build decision trees for different machine tools including pump, air compressor etc**[L-4]**
- classify the different types of faults in machine tools and their causes**[L-3]**

Unit V   **10L**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing,
cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Learning Outcomes

After the completion of this unit, the student will be able to
- explain the concept of periodic inspection and its need**[L-2]**
- list the common troubles and remedies of electric motor**[L-1]**
- define the need for preventive maintenance and list its steps**[L-3]**
- elaborate the steps/procedure of periodic and preventive maintenance of diesel generating sets, pumps etc**[L-2]**

Text Book(s):
1. Lindley R. Higgins, Lester Coridon Morrow, Maintenance Engineering Handbook, Da Information Services, 1977.
2. H. P. Garg, Maintenance Engineering, S. Chand and Company, 1987.
3. Audels, Pump-hydraulic Compressors, Mc Graw Hill Publication, 1992.
4. Winterkorn, Hans, Foundation Engineering Handbook, Chapman & Hall London, 1975

Course Outcomes:

Upon successful completion of the course, the student will be able to

- describe the different facets and aspects of industrial systems safety**[L-2]**
- demonstrate the use of tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings**[L-4]**
- define the function and list the types of maintenance activities**[L-1]**
- describe the concept of wear and corrosion mechanisms and their prevention methods**[L-2]**
- enumerate the different faults and their tracing mechanisms **[L-3]**
- elaborate the planning periodic and preventive maintenance mechanisms needed for industrial safety**[L-4]**

19EOE746: OPERATIONS RESEARCH

L T P C
3 0 0 3

Optimization problems arise in all walks of human activity- particularly in engineering, business, finance and economics. The simplest optimization problems are linear in nature which may be subject to a set of linear constraints. This course will equip the student with the expertise to mathematically model real life optimization problems as Linear Programming (Optimization) Problems and subsequently educate the student to solve these models with the help of the available methods.

Course Objectives
- to impart knowledge on developing mathematical formulation for linear programming and transportation problem
- to familiarize the student in the construction of the required activities in an efficient manner to complete it on or before a specified time limit and at the minimum cost.
- to expose the development of mathematical model for interactive decision-making situations, where two or more competitors are involved under conditions of conflict and competition.
- to illustrate PERT and CPM techniques for planning and implementing projects.
- To impart the knowledge of formulating and analysis of real life problems using advanced tools and techniques for resource optimization
- to provide frameworks for analyzing waiting lines using advanced queuing theory concepts

Unit I   **8L**
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models
Learning Outcomes
After completing this unit, the student will be able to
- identify and develop operational research models from the verbal description of the real system. **[L4]**
- understand the classification systems of effective Inventory control models**[L-2]**

Unit II   **8L**
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming
Learning Outcomes
After completing this unit, the student will be able to
- translate a real-world problem, given in words, into a mathematical formulation. **[L-2]**
- utilize the mathematical tools that are needed to solve optimization problems. **[L-2]**

Unit III   **8L**
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT
Learning Outcomes
After completing this unit, the student will be able to

- describe the need and origin of the optimization methods**[L-2]**
- classify optimization problems to suitably choose the method needed to solve the particular type of problem**[L-3]**

Unit IV   **8L**
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.
Learning Outcomes
After completing this unit, the student will be able to
- choose linear programming problems to suitably choose the method needed to solve the particular type of problem**[L-1]**
- identify industrial problems involved in inventory, MRP and scheduling**[L-2]**

Unit V   **8L**
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation
Learning Outcomes
After completing this unit, the student will be able to
- identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem**[L-2]**
- Apply the models to incorporate rational decision-making process in real life situations.**[L3]**
- Analyze various modeling alternatives & select appropriate modeling techniques for a given situation. **[L-3]**

Text Book(s):
1. H.A. Taha, Operations Research, An Introduction, Prentice Hall of India, 2008
2. H.M. Wagner, Principles of Operations Research, Prentice Hall of India, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, 2008
4. Hitler Libermann Operations Research: McGraw Hill Publishers, 2009
5. Pannerselvam, Operations Research: Prentice Hall of India, 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India, 2010

Course Outcomes
After the successful completion of the course, the students will be able to:
- Understand the basic concepts of different advanced models of operations research and their applications. **[L-2]**
- Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action. **[L-4]**
- Apply the models to incorporate rational decision-making process in real life situations. **[L-4]**
- Analyze various modeling alternatives & select appropriate modeling techniques for a given situation. **[L-3]**
- Validate output from model to check feasibility of implementations. **[L-5]**
- Create innovative modeling frameworks for a given situation. **[L-6]**
- Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship. **[L-3]**

19EOE748: COST MANAGEMENT OF ENGINEERING PROJECTS

	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

This course will equip the student with the expertise to mathematically model engineering projects and use effective methods and techniques to plan and execute engineering activities.

Course Objectives
- to introduce the basic principles of strategic cost management and the related terminology
- to familiarize the project planning and execution process involving technical/nontechnical activities
- to acquaint the student with detailed engineering activities and their cost management analysis
- to impart the knowledge of cost analysis and profit planning of engineering projects
- to familiarize the quantitative techniques for optimization of budget allocation

Unit I   **8L**
Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational
control; Provision of data for Decision-Making.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the cost concepts in decision making**[L-2]**
- define the various costs involved in the cost management process**[L-2]**
- list the objectives of cost control**[L-2]**
- identify the different fields of a database for operational control**[L-2]**

Unit II   **8L**
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.
Learning Outcomes
After the completion of this unit, the student will be able to
- define the meaning of a project and list the different types**[L-2]**
- identify the measures to manage cost overruns**[L-2]**
- describe the various stages of project execution from conception to commissioning**[L-2]**
- plan the proper order of technical/nontechnical activities as part of project execution**[L-2]**

Unit III   **8L**
Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.
Learning Outcomes
After the completion of this unit, the student will be able to
- identify the different clearance norms required in the pre-project execution phase**[L-2]**
- describe the hierarchy of project team and identify the role of each member**[L-2]**

- list the different contents of project contracts**[L-2]**
- present the project cost control and planning through bar charts, network diagrams etc**[L-2]**

Unit IV   **8L**
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the cost behavior and profit planning**[L-2]**
- distinguish between marginal costing and absorption costing**[L-2]**
- analyze the variance of standard costing**[L-2]**
- analyze the pricing strategies in project costing**[L-2]**
- identify the quality measures satisfying the appropriate constraints**[L-2]**

Unit V   **10L**
Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory
Learning Outcomes
After the completion of this unit, the student will be able to
- define and compare the different budgeting strategies**[L-2]**
- model the cost management as a linear programming problem**[L-2]**
- measure the divisional profitability and decide the appropriate pricing**[L-2]**

Textbook(s)
1. Charles T. Horngren, Srikant M. Datar, George Foster, Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2006.
References:
1. Charles T. Horngren, George Foster, Advanced Management Accounting, Greenwood Publishing, 2001.
2. Robert S Kaplan, Anthony A. Alkinson, Management & Cost Accounting, 1998.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting, Wheeler Publisher, 2004.
4. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book, 2006.

Course Outcomes:
After the successful completion of the course, the students will be able to
- list the basic principles of strategic cost management and define the related terminology**[L-1]**
- plan the project execution process involving technical/nontechnical activities**[L-4]**
- describe the detailed engineering activities and their cost management analysis**[L-2]**
- carry out the cost analysis and profit planning of engineering projects**[L-5]**
- utilize quantitative techniques for optimization of budget allocation**[L-6]**

19EOE752: WASTE TO ENERGY

L T P C
3 0 0 3

This course introduces the basic principles and different technologies of converting waste to energy. Student will be able to appropriately identify the methods and build biomass gasification systems of different capacities depending on application requirements.

Course Objectives:
- to introduce the classification of waste for its usefulness in preparing different fuels
- to familiarize the biomass pyrolysis process and its yield issues
- to acquaint the student with biomass gasification processes and construction arrangements
- to impart the types and principles of biomass combustors
- to familiarize the calorific values and composition of biogas resources

Unit I **8L**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Learning Outcomes

After the completion of this unit, the student will be able to
- distinguish between different types of waste **[L-1]**
- classify the different types of waste for manufacturing different types of fuel **[L-3]**
- identify the different conversion devices and their applications**[L-4]**

Unit II **8L**

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Learning Outcomes

After the completion of this unit, the student will be able to
- classify the different types of pyrolysis methods based on speed**[L-1]**
- describe the different methods of manufacturing charcoal **[L-2]**
- explain the chemical processes involved in the manufacture of pyrolytic oils and gases**[L-2]**

Unit III **8L**

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic
consideration in gasifier operation.

Learning Outcomes

After the completion of this unit, the student will be able to
- explain the design, construction and operation of different gasifiers**[L-2]**
- describe the burner arrangement for thermal heating**[L-2]**
- elaborate the gasifier engine arrangement for equilibrium and kinetic considerations**[L-3]**

Unit IV **8L**

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Learning Outcomes
After the completion of this unit, the student will be able to
- explain the basic principle of biomass combustors**[L-2]**
- classify different combustors based on their capacity and efficiency**[L-3]**
- describe the construction and operation of fixed bed inclined grate, fluidized bed combustors **[L-2]**

Unit V   **10L**
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.
Learning Outcomes
After the completion of this unit, the student will be able to
- list the properties of biogas**[L-1]**
- elaborate the design, construction and operation of biogas plant**[L-2]**
- classify the different biomass resources and their conversion process**[L-3]**
- distinguish between different biogas plants and identify their applications**[L-5]**

Text Book(s):
1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Outcomes:
After the successful completion of the course, the student will be able to
- classify different types of waste for their usefulness in preparing different fuels**[L-3]**
- describe the biomass pyrolysis process and its yield issues**[L-2]**
- outline the different biomass gasification processes and their construction arrangements**[L-3]**
- explain the types and principles of biomass combustors**[L-2]**
- analyze the calorific values and composition of biogas resources**[L-5]**

L	T	P	C
0	0	4	2

Supply Chain Management Lab mainly focuses on the research field related to Supply Chain and Logistics Management. More specifically on Integrated Logistics System, Manufacturing SCM, Green and Sustainable SCM, Supply Chain Safety, and Robust & Resilient Supply Chain Network Design. A student applying to the SCM Lab for research in the Supply Chain Management area normally should have the background in Operations Research, Optimization, Simulation, and Statistics.

List of Experiments:
1. Network design and operations
2. Designing and planning transportation networks
3. Designing and planning distribution networks
4. Value Stream Mapping – Development of Current State Map and Future State Map
5. Decision Making in Supply Chains
6. Lean, agile and leagile supply chains
7. Supply chain restructuring
8. Supply chain performance measures
9. Inventory optimization in supply chain
10. Forecasting models in supply chain

Course Outcomes:
After going through this course the student will be able to
➢ understand supply chain concepts, systemic and strategic role of SCM in the global competitive environment. **[L-2]**
➢ evaluate alternative supply and distribution network structures using optimization models. **[L-5]**
➢ develop optimal sourcing and inventory policies in the supply chain context. **[L-6]**
➢ select appropriate information technology frameworks for managing supply chain processes. **[L-6]**

19EIE724: SIMULATION LABORATORY

L T P C
0 0 4 2

The simulation lab is a systems approach to problem solving/system design will be stressed. Since proficiency with simulation can only be achieved from hands on experience, a computer simulation tool (Arena) will be applied to a progression of projects including manufacturing/production systems, transportation, service, bank system, etc. The lab will also stress the importance of communications of simulation results through written report and verbal presentations. Data analysis and approaches to presenting simulation results will also be introduced. Upon completion of this lab, the students will be expected to be able to model complex, real-life industrial systems using computer simulation methods.

List of Experiments:
1. Introduction to Simulation Packages and selection.
2. Excel simulation of inventory model
3. Building simulation Models for Banking service (Bank teller problem)
4. Building simulation Models for Mortgage application problem
5. Building simulation Models for Post office animation
6. Building simulation Models for food processing problem
7. Simulation of garment stitching industry
8. Simulation of a supermarket
9. Simulation of a health care system
10. Simulation of the axle manufacturing process
11. Simulation of the vehicle traffic system
12. A building simulation model for manufacturing cell with transporter system

Course Outcomes:
After the successful completion of the course, the students will be able to:
- describe the role of important elements of discrete-event simulation and modeling paradigm. **[L-1]**
- conceptualize real-world situations related to systems development decisions, originating from source requirements and goals. **[L-2]**
- develop skills to apply simulation software to construct and execute goal-driven system models. **[L-6]**
- interpret the model and apply the results to resolve critical issues in a real-world environment**[L-2]**

	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Objectives:
- ➢ To create awareness to recognize recent developments in Electronics & Communication and in multidisciplinary fields.
- ➢ To summarize the recent technologies and inculcate the skills for literature survey.
- ➢ To demonstrate good presentation skills.
- ➢ To plan and improve the Technical Report writing skills.
- ➢ To support Group discussion and Teamwork.

General Guidelines for the Seminar:
1. The seminar has to be presented by an individual student.
2. The topic of the seminar should be from current thrust area. This is to be decided in consent with the internal guide.
3. The topic can be based on standard papers (like IEEE/ACM/CSI etc.) in the thrust area for the selected topic.
4. Each student has to prepare a technical paper out of the seminar topic.
5. Presenting/publishing this paper in conference/ Journal will be given weightage in CIE.
6. The student needs to submit both hard & soft copy of the seminar report.

Course Outcomes:
At the end of this course the student will be able to:
- • Understand and interpret the latest advancements through different technical papers, reports, Journals, Datasheets, books, etc..
- • Communicate his/her ideas with his peers as the audience, which will enhance both oral and written communication skills.
- • Learn to manage resources effectively.
- • Create interest to pursue lifelong learning.

19EAC741: ENGLISH FOR RESEARCH PAPER WRITING

	L	T	P	C
	2	0	0	0

This course introduces the student, to the different aspects of research paper writing including planning, preparation, layout, literature review write-up etc. Specifically the perspective and style of writing in different sections of a research paper is highlighted. Students will exposed to English language skills relevant to research paper writing.

Course Objectives:
- ➢ To write clearly, concisely and carefully by keeping the structure of the paper in mind.
- ➢ To use standard phrases in English and further improve his command over it.
- ➢ To write with no redundancy, no ambiguity and increase the readability of the paper.
- ➢ To plan and organize his paper by following a logical buildup towards a proper conclusion.
- ➢ To decide what to include in various parts of the paper.
- ➢ To write a suitable title and an abstract in order to attract the attention of the reader.
- ➢ To identify the correct style and correct tense.
- ➢ To retain the scientific value of the paper by using minimum number of words.

Unit I   **5L**
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.
Learning Outcomes:
After the completion of this unit, the student will be able to
- • To know the expectations of various journals and referees **[L-2]**
- • To know the typical structure of a paper **[L-3]**
- • Learn to put words in a sentence in the correct order **[L-4]**
- • To write short and clear sentences from the very beginning of the paper **[L-4]**
- • To increase the readability of the paper by making it easy to read and 100% clear **[L-4]**
- • Learn to be concise without losing any important content **[L-4]**
- • To avoid some typical grammar mistakes made in research papers **[L-4]**

Unit II   **5L**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.
Learning Outcomes:
After the completion of this unit, the student will be able to
- • Learn to make useful contribution worth recommending for publication **[L-4]**
- • Learn good use of language to make readers notice the key findings **[L-4]**
- • Learn to anticipate or predict possible objections to the claims made in the paper**[L-5]**
- • To understand what is plagiarism, and how to paraphrase other people's work **[L-4]**
- • Learn to attract the right kind of readers with a suitable title**[L-3]**
- • Learn to sell the abstract to potential readers by attracting their curiosity **[L-2]**

Unit III   **6L**
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.
Learning Outcomes:
After the completion of this unit, the student will be able to
- have a deep knowledge about everything that has been previously written on the topic and decide   what is important to know in Introduction. **[L-3]**
- Learn to provide the right amount of literature regarding the sequence of events leading up to the current situation in the Literature review**[L-4]**

Unit IV   **6L**
Writing Skills: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.
Learning Outcomes:
After the completion of this unit, the student will be able to
- Learn to describe the materials used in experiments and/or the methods used to carry out the research **[L-2]**
- The key skill is in reporting the results simply and clearly **[L-3]**
- Learn to structure the Discussion and satisfy the typical requirements of the referees **[L-4]**
- Learn to provide a clear and high-impact take-home message in the conclusion **[L-5]**

Unit V   **6L**
Good Paper Writing: Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.
Learning Outcomes:
After the completion of this unit, the student will be able to
- Learn various lists of frequently used phrases that have a general acceptance in all disciplines and use in specific sections of the paper **[L-3]**
- Learn various kinds of things one should look for when doing the final check **[L-3]**

Text Book (s)**:**
1. Goldbort R, Writing for Science, Yale University Press, 2006
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006
3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM, Highman, 1998.

References:
1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes:
By the end of the course the students will be able to:
- Frame the structure of the paper precisely **[L-2]**
- Improve his command over English by using standard phrases**[L-3]**
- Avoid repetition and mistakes in the paper and increase its readability**[L-3]**
- Organize the paper logically towards a proper conclusion. **[L-4]**
- Decide on the content to be included in various parts of the paper. **[L-5]**.
- Identify whether to use personal or impersonal style in the paper. **[L-5]**

- Express the content in a clear and concise way. **[L-6]**
- Attract the attention of the reader by providing a suitable title and an appropriate abstract. **[L-6]**

19EAC742: DISASTER MANAGEMENT

L T P C
2 0 0 0

This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision-making process for Disaster Risk Reduction.

Course Objectives:
- ➢ to provide students an exposure to disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
- ➢ to ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
- ➢ equipped with knowledge, concepts, and principles, skills pertaining to Planning, Organizing, Decision-making and Problem solving methods for Disaster Management.
- ➢ to develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Unit I   **5L**
Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
Learning Outcomes
After the completion of this unit, the student will be able to
- • define the meaning, list the factors and mention the significance of disaster **[L-1]**
- • distinguish between hazard and disaster **[L-3]**
- • compare manmade and natural disaster **[L-3]**
- • list the types of disaster and describe their magnitude **[L-2]**

Unit II   **5L**
Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
Learning Outcomes
After the completion of this unit, the student will be able to
- • list the different repercussions of disasters and hazards**[L-1]**
- • describe the characteristics of natural disasters and the magnitude of their losses**[L-2]**
- • describe the characteristics of man-made disasters and the magnitude of their losses**[L-2]**
- • elaborate the outbreaks of diseases and epidemics after disasters **[L-3]**

Unit III   **6L**
Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the seismic zones and their characteristics**[L-2]**
- identify the areas prone to floods and droughts**[L-1]**
- distinguish between landslides and avalanches**[L-3]**
- identify areas prone to cyclonic and costal hazards**[L-4]**
- enumerate the post disaster diseases and epidemics**[L-2]**

Unit IV   **6L**
Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, media reports: governmental and Community Preparedness.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the monitoring of phenomena triggering a disaster/hazard**[L-2]**
- evaluate the risk with the use of remote sensing and meteorological data**[L-5]**
- list the governmental and community measures for disaster preparedness**[L-2]**

Unit V   **6L**
Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival
Learning Outcomes
After the completion of this unit, the student will be able to
- define and list the elements of disaster risk**[L-1]**
- enumerate the measures for risk reduction**[L-2]**
- apply the techniques of risk assessment **[L-4]**
- identify the means of people's participation in risk assessment**[L-2]**

Text Book(s):
1. R. Nishith, Singh A.K., Disaster Management in India: Perspectives, issues and strategies, New Royal Book Company., 2008.
2. Sahni, Pardeep, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi., 2012
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep and Deep Publication, 2007.

Course Outcomes:
At the end of the course, student will be able to
- Identify management activities in pre, during and post phases of Disasters. **[L-1]**
- Plan disaster management activities and specify measure for risk reduction**[L-4]**
- apply risk assessment techniques in real life disaster scenarios**[L-4]**

19EAC743: SANSKRIT FOR TECHNICAL KNOWLEDGE

L T P C
2 0 0 0

This course is intended to expose the student to the fundamentals of Sanskrit language and its technical utility in forming the core principles of many engineering branches. Students taking this course shall be able to relate the core principles of engineering branches to semantics of Sanskrit language

Course Objectives:
- ➢ to provide the knowledge of Sanskrit alphabets
- ➢ to expose the students to the basic grammar and sentence formation in past/present/future tenses
- ➢ to provide a classification of Sanskrit literature and its associated roots
- ➢ to demonstrate the relation of core engineering principles to the roots of Sanskrit literature

Unit I 9L
Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.
Learning Outcomes
After the completion of this unit, the student will be able to
- List the different alphabets in Sanskrit **[L-1]**
- Form sentences in past, present and future tenses **[L-4]**
- Form concise/simple sentences with the right usage of words **[L-4]**

Unit II 9L
Order, Introduction of roots, Technical information about Sanskrit Literature.
Learning Outcomes
After the completion of this unit, the student will be able to
- classify the different branches of Sanskrit literature **[L-3]**
- describe the order and roots of Sanskrit literature **[L-2]**
- relate the applicability of Sanskrit literature to technical principles **[L-5]**

Unit III 9L
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics
Learning Outcomes
After the completion of this unit, the student will be able to
- relate the technical concepts of engineering to principles of electrical technology **[L-2]**
- relate the technical concepts of engineering to principles of mechanical engineering **[L-2]**
- apply the use of Sanskrit knowledge to describe the mathematical principles **[L-4]**

Text Book(s):
1. Dr.Vishwas, Abhyaspustakam, Samskrita Bharti Publication, New Delhi, 2005.
2. Vempati Kutumb Shastri, Teach Yourself Sanskrit, Prathama Deeksha, Rashtriya Sanskrit Sansthanam, New Delhi Publication, 2003.
3. Suresh Soni, India's Glorious Scientific Tradition, Ocean books, New Delhi, 2011.

Course Outcomes:
After successful completion of the course, the student will be able to
- get a working knowledge in illustrious Sanskrit, the scientific language in the world **[L-3]**
- get a Learning of Sanskrit to improve brain functioning **[L-4]**
- develop the logic in mathematics, science & other subjects with principles of sanskrit**[L-4]**
- explore the huge knowledge from ancient literature with the help of sanskrit**[L-5]**

19EAC744: VALUE EDUCATION

	L	T	P	C
	2	0	0	0

This course is intended to expose the student to the need for human values and methods to cultivate them for leading an ethical life with good moral conduct. Students taking this course will be able to experience a change in personal and professional behavior with these ethical principles guiding him throughout life

Course Objectives:
- ➢ to expose the student to need for values, ethics, self-development and standards
- ➢ to make the student understand the meaning of different values including duty, devotion, self-reliance etc.
- ➢ to imbibe the different behavioral competencies in students for leading an ethical and happy life
- ➢ to expose the student to different characteristic attributes and competencies for leading a successful, ethical and happy profession life.

Unit I   **7L**
Values and self-development –social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements
Learning Outcomes
After the completion of this unit, the student will be able to
- define the social values and individual attitudes for self development**[L-1]**
- describe the Indian vision of humanism**[L-2]**
- distinguish between moral and non-moral acts **[L-3]**
- list the standards and value principles for moral conduct **[L-2]**

Unit II   **7L**
Importance of cultivation of values. Sense of duty. Devotion, self-reliance. Confidence, concentration. Truthfulness, cleanliness. Honesty, humanity. Power of faith, national unity. Patriotism, love for nature, discipline.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the importance of cultivating values**[L-2]**
- list the different traits of self-developed individual**[L-1]**
- explain the need for loving nature/country/humanity**[L-2]**

Unit III   **7L**
Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the benefits of positivie thinking, integrity and discipline**[L-2]**
- list the different methods for avoiding fault finding, anger**[L-1]**
- explain the methods to overcome suffering, religious intolerance, self-destructive habits**[L-2]**

Unit IV   **7L**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying   effectively.

Learning Outcomes

After the completion of this unit, the student will be able to
- describe the science of reincarnation**[L-2]**
- explain the relation between self-management and good health**[L-1]**
- elaborate the role of different religions in reaching the common goal**[L-3]**
- list the different techniques for mind-control to improve personality and studies**[L-1]**

Text Book(s):
1. Chakroborty S.K., "Values and ethics for organizations: Theory and Practice", Oxford University Press, 1998.

Course Outcomes:

After successful completion of the course, the student will be able to
- describe the need for human values and methods for self development **[L-2]**
- elaborate the different traits and benefits of a self-developed individual **[L-1]**
- list the different attributes of self-developed individual **[L-1]**
- elaborate the role and scope of books/faith/health/religions in character building and competence development**[L-3]**

19EAC745: CONSTITUTION OF INDIA

	L	T	P	C
	2	0	0	0

This course is intended to expose the student to the philosophy of Indian constitution. Students will be able to understand their fundamental rights/duties and governance structure. Students also appreciate the role of election commission in establishing a democratic society.

Course Objectives:
- ➢ to familiarize the student about the need for a constitution
- ➢ to make the student understand the role of constitution in a democratic society
- ➢ to acquaint the student with key constitutional features and fundamental rights of a citizen
- ➢ to impart the organs of governance and local administration hierarchy and their responsibilities
- ➢ to familiarize the student with the role, responsibilities and administration hierarchy of election commission

Unit I   **5L**
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working). **Philosophy of the Indian Constitution**: Preamble, Salient Features
Learning Outcomes
After the completion of this unit, the student will be able to
- • list the outline of drafting committee and their roles in the making of Indian constitution **[L-1]**
- • describe the need and role of a constitution in a democratic society**[L-2]**
- • elaborate the salient features of Indian constitution**[L-3]**

Unit II   **5L**
Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
Learning Outcomes
After the completion of this unit, the student will be able to
- • list the fundamental rights of a citizen**[L-1]**
- • explain the intricacies in the different rights**[L-2]**
- • elaborate the fundamental duties of a citizen**[L-3]**
- • describe the principles of state policy**[L-2]**

Unit III   **6L**
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions
Learning Outcomes
After the completion of this unit, the student will be able to
- • present the hierarchy of governance **[L-2]**
- • list the role/responsibilities/powers of different organs of governance**[L-1]**
- • elaborate the guidelines for appointment/transfer of judges**[L-2]**

Unit IV   **6L**
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the administrative organizational hierarchy of municipalities and panchayats**[L-2]**
- appreciate the role/responsibilities/powers of mayor, CEO, elected officials**[L-3]**
- appreciate the importance of grass root democracy**[L-3]**

Unit V   **6L**
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the administrative hierarchy of election commission**[L-2]**
- elaborate the roles/responsibilities/powers of election commissioners at different levels of hierarchy**[L-3]**
- outline the welfare activities of SC/ST/OBC/Women by different bodies**[L-3]**

Text Book(s):
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1/e, 2015.
3. M. P. Jain, Indian Constitution Law, 7/e, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:
After successful completion of the course, the student will be able to
- describe the philosophy and salient features of Indian constitution**[L-2]**
- list the constitutional rights and duties of a citizen**[L-1]**
- elaborate the central and local administrative hierarchy and their roles**[L-2]**
- describe the roles/responsibilities/powers of different governing and administrative bodies **[L-2]**
- explain the structure/functioning and power of election commission**[L-2]**

19EAC746: PEDAGOGY STUDIES

L	**T**	**P**	**C**
2	**0**	**0**	**0**

This course is aimed to familiarizing the student with pedagogical principles, practices and methodologies. This course is intended for students interested in pursuing a career in teaching and research.

Course Objectives:
- ➢ to familiarize the student about the need for pedagogy studies, background and conceptual framework
- ➢ to expose the student to pedagogical practices in formal/informal classrooms
- ➢ to acquaint the student with type of curriculum and guidance materials for effective pedagogy
- ➢ to familiarize the student with classroom practices and curriculum assessment procedures
- ➢ to make the student understand the effect of undertaking research on teaching quality

Unit I   **5L**
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.
Learning Outcomes
After the completion of this unit, the student will be able to
- define the aim and rationale behind teacher education**[L-1]**
- classify the different theories of learning **[L-1]**
- elaborate the need and role of curriculum, teacher education **[L-1]**

Unit II   **5L**
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the different pedagogical practices used by teachers in formal and informal classrooms**[L-1]**
- explain the pedagogical practices employed in developing countries **[L-1]**
- enumerate the duties of faculty in terms of teaching, research, consultancy, administration **[L-1]**

Unit III   **6L**
Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.
Learning Outcomes
After the completion of this unit, the student will be able to
- list the measures for effective pedagogy**[L-1]**

- identify the different documentation required to formalize curriculum implementation and quality assessment**[L-1]**
- describe the teachers attitudes and beliefs in pedagogic strategies**[L-2]**

Unit IV   **6L**
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.
Learning Outcomes
After the completion of this unit, the student will be able to
- define the organizational hierarchy in a school administration system**[L-1]**
- list the different barriers to learning**[L-3]**
- enumerate the methods to overcome limited resources and handle large class sizes**[L-3]**
- describe the follow-up support and peer-support in classroom practices**[L-2]**

Unit V   **6L**
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.
Learning Outcomes
After the completion of this unit, the student will be able to
- explain the need for and role of research in teaching profession**[L-2]**
- list the different research activities to be taken up by teachers**[L-1]**
- describe the impact of research on teaching quality and learning process**[L-2]**

Text Book(s):
1. Ackers J, Hardman F, Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261, 2001
2. Agrawal M, Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379, 2004.
3. Akyeampong K, Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID., 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282., 2013.
5. Alexander RJ, Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell., 2001.
6. Chavan M, Read India: A mass scale, rapid, 'Learning to Read' campaign., 2003.

Course Outcomes:
After successful completion of the course, the student will be able to
- describe the theories of learning and conceptual framework of pedagogy**[L-2]**
- explain the pedagogical practices used by teachers in formal and informal classrooms **[L-2]**
- visualize the administrative hierarchy of schools and colleges and define the role**[L-3]**
- appreciate the need for research and define the future direction of teaching career**[L-3]**
- describe the impact of curriculum and assessment on the teaching learning process of a student**[L-3]**

19EAC747: STRESS MANAGEMENT BY YOGA

	L	T	P	C
	2	0	0	0

This course is aimed to familiarize the student with basic principles of yoga and different physical/mental practices for managing mind and body. This course helps the student in managing stress during education, home and workplace. Further, principles learnt in this course help in building overall personality for a stress-free, happy and independent life.

Course Objectives:
- ➢ to familiarize the student about eight parts of yoga and their significance
- ➢ to expose the student to the importance and meaning of Yam and Niyam
- ➢ to make the student understand the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc
- ➢ to introduce the different yogic poses with a knowledge of their benefits for mind and body
- ➢ to familiarize the effect of different types of breathing techniques in concept and in activity

Unit I   **9L**
Definitions of Eight parts of yoga (Ashtanga).
Learning Outcomes
After the completion of this unit, the student will be able to
- • list the eight parts of yoga **[L-1]**
- • describe the effects of different parts of yoga on mind and body**[L-2]**
- • elaborate the importance of yoga in stress management and personality development**[L-3]**

Unit II   **9L**
Yam and Niyam.
Do`s and Don't's in life.
   i) Ahinsa, satya, astheya, bramhacharya and aparigraha
   ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.
Learning Outcomes
After the completion of this unit, the student will be able to
- • elaborate the importance of Yam and Niyam**[L-2]**
- • describe the meaning and significance of Ahinsa, satya, astheya etc**[L-2]**
- • explain the need for shaucha, santosh, tapa, swadhyay in leading a healthy and fruitful life**[L-3]**

Unit III   **9L**
Asan and Pranayam
   i) Various yog poses and their benefits for mind & body
   ii) Regularization of breathing techniques and its Effects-Types of pranayam.
Learning Outcomes
After the completion of this unit, the student will be able to
- • demonstrate the different physical asanas and explain their physical and phychological effects**[L-4]**
- • demonstrate the different breathing techniques and describe their physical and mental effects **[L-4]**
- • distinguish between different types of pranayamam**[L-5]**

Text Book(s):
1. Janardan, Yogic Asanas for Group Tarining-Part-I, Swami Yogabhyasi Mandal, Nagpur
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama, Kolkata

Course Outcomes:
After successful completion of the course, the student will be able to
- describe the eight parts of yoga and their significance **[L-1]**
- explain the the importance and meaning of Yam and Niyam **[L-2]**
- define the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc **[L-1]**
- demonstrate the different yogic poses and explain their benefits for mind and body**[L-4]**
- demonstrate the different types of breathing techniques and explain their physical and mental benefits**[L-5]**

19EAC748: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

	L	T	P	C
	2	0	0	0

This course is aimed to familiarize the student with life enlightenment skills for personality development. This course helps the student in building his holistic personality through human values, ethics and spiritual attributes.

Course Objectives:
- ➢ to familiarize the student to good personality traits through moral stories
- ➢ to make the student understand the goal of human life and importance of good personality in reaching the goal
- ➢ to expose the student to the study of Shrimad-Bhagwad-Geeta for developing his/her personality and achieve the highest goal in life
- ➢ to familiarize the student to leadership skills for driving nation and mankind to peace and prosperity
- ➢ to expose the role of Neetishatakam for developing versatile personality of students.

Unit I   **9L**
Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's).
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the moral stories illustrating the traits of good personality**[L-2]**
- define the meaning and importance of wisdom, pride, heroism, virtue etc**[L-1]**
- identify do and donts in life from the foundations of human morals/ethics**[L-5]**

Unit II   **9L**
Approach to day to day work and duties.
Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.
Learning Outcomes
After the completion of this unit, the student will be able to
- describe the characteristics and principles of bhakti yogam, jnana yogam and karma yogam **[L-1]**
- identify the use of different yogic characteristics in different activities of daily life/duties**[L-4]**
- apply the use of yogic principles for leading a stress-free, happy and fruitful life with good developed personality**[L-4]**

Unit III   **9L**

Statements of basic knowledge.

Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68

Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model. Shrimad BhagwadGeeta:

Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

Chapter 4-Verses 18, 38,39

Chapter18 – Verses 37,38,63

Learning Outcomes

After the completion of this unit, the student will be able to

- list the characteristics of role model proposed by verses of bhagavad gita**[L-1]**
- explain the methods for obtaining life enlightenment through the practice of four yoga appropriately **[L-2]**
- describe the characteristics of karma yogi/jnana yogi for developing leadership personality **[L-2]**

Text Book(s):

1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata
2. P. Gopinath, Bhartrihari's Three Satakam (Niti-Sringar-vairagya), Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes:

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

- List the different parables of neethisathakam and identify their morals**[L-1]**
- enumerate the different traits of human personality for life enlightenment**[L-2]**
- describe the leadership attributes for driving nation and mankind to peace and prosperity**[L-2]**
- explain the applicability of different types of yoga to day-to-day work and duties resulting in responsible personality **[L-2]**

19EAC750: DEVELOPING SOFT SKILLS AND PERSONALITY

	L	T	P	C
	3	0	0	0

Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The course aims to cause a basic awareness within the students about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality.

Course Objectives:
- ➢ to familiarize the student to the criteria for self assessment and significance of self-discipline
- ➢ to expose the student to attitudes, mindsets, values and beliefs
- ➢ to acquaint the student to plan career and goals through constructive thinking
- ➢ to enable the student to overcome barriers for active listening and persuasive speaking
- ➢ to familiarize the skill of conducting meetings, writing minutes and involving in active group discussions

Unit I (8L)
Self-Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives; Developing Self-Esteem and Building Self-Confidence, Significance of Self-Discipline
Learning Outcomes
After the completion of this unit, the student will be able to
- • identify strengths & limitations through self-assessment**[L-3]**
- • list the attributes of personalities will good will-power and self-drives**[L-1]**
- • describe the reasons for building self-esteem and self-confidence**[L-2]**
- • explain the significance of self discipline**[L-2]**

Unit II (8L)
Understanding Perceptions, Attitudes, and Personality Types: Mind-Set: Growth and Fixed;
Values and Beliefs
Learning Outcomes
After the completion of this unit, the student will be able to
- • define the characteristics of different perceptions, attitudes and personality types**[L-1]**
- • distinguish between fixed and growing mindsets**[L-3]**
- • define the importance and meaning of values and beliefs**[L-2]**

Unit III (8L)
Motivation and Achieving Excellence; Self-Actualisation Need; Goal Setting, Life and Career Planning; Constructive Thinking
Learning Outcomes
After the completion of this unit, the student will be able to
- • describe the need for having high motivation and achieving excellence**[L-2]**
- • define the need for self-actualization**[L-1]**
- • plan the life and career goals based on self assessment**[L-4]**
- • explain the attributes of constructive thinking**[L-2]**

Unit IV (8L)

Communicating Clearly: Understanding and Overcoming barriers; Active Listening; Persuasive Speaking and Presentation Skills.

Learning Outcomes

After the completion of this unit, the student will be able to
- self-assess the barriers for communicating clearly **[L-4]**
- list the attributes of active listening**[L-1]**
- describe the minimal aspects of effective presentation**[L-2]**
- organize ideas resulting a persuasive talk**[L-3]**

Unit V (8L)

Conducting Meetings, Writing Minutes, Sending Memos and Notices; Netiquette: Effective E-mail Communication; Telephone Etiquette; Body Language in Group Discussion and Interview.

Learning Outcomes

After the completion of this unit, the student will be able to
- describe the format and structure of writing meeting minutes**[L-2]**
- identify the essential components of memos and notices**[L-3]**
- explain the principles of effective email communication**[L-2]**
- list the basic etiquette of telephone conversation**[L-1]**
- describe the effective body traits during group discussion and interviews**[L-2]**

Text Books:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman& Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

Course Outcomes:

After successful completion of the course, the student will be able to
- carry out self assessment and describe the significance of self-discipline **[L-4]**
- define, classify and compare attitudes, mindsets, values and beliefs**[L-3]**
- plan career and goals through constructive thinking and personal assessment **[L-4]**
- overcome barriers for active listening and persuasive speaking **[L-5]**
- conduct meetings, write minutes and involve in active group discussions**[L-3]**

19EIE891: PROJECT WORK-I

L T P C
0 0 26 13

Each student is required to submit a report of first part of project work i.e. about the problem definition, literature review and methodology to be adopted including experiments and tests to be performed on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester end.

19EIE892: PROJECT WORK-II

L T P C
0 0 26 13

Each student is required to submit a detailed project report about the work on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester as per the guidelines decided by the department from time to time. The candidate shall present/publish one paper in national/international conference/seminar/journal of repute. However candidate may visit research labs/institutions with the due permission of chairperson on recommendation of supervisor concerned.