OBE COURSE SHEET

Department of Industrial Engineering, U.E.T Peshawar

Assessment Criteria:

The course sheet is presented without the assessment criteria

TABLE OF CONTENTS

Program Educational Objectives (PEOs)

1. Ability to be employed in manufacturing and service sector
2. Ability to pursue higher education
3. Ability to operate own businesses

PEOs Key Performance Indicators (KPIs)

S. No	PEOs	KPI
1	Ability to be employed in manufacturing and service sector	60 percent
2	Ability to pursue higher education	30 percent
3	Ability to operate own businesses	10 percent

Program Learning Outcomes (PLOs)

1. Engineering Knowledge

An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. Problem Analysis

An ability to identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. Design / Development of Solutions

An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

4. Investigation

An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

5. Modern Tool Usage

An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

6. The Engineer and Society

An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

7. Environment and Sustainability

An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

8. Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

9. Individual and Teamwork

An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

10. Communication

An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management

An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

12. Lifelong Learning

An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

SCHEME OF STUDIES FOR 1ST SEMESTER

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
1	1	BSI-101	Islamic Studies	(2-0-2)	Humanities	None	
	2	BSI-142	English Composition and Comprehension	(3-0-3)	Humanities	None	
	3	BSI-122	Calculus	(3-0-3)	Natural Sciences	None	
	4	ME-105	Engineering Drawing	(3-1-4)	Engineering Foundation	None	3
	5	IE-115	Introduction to Computing	(2-1-3)	Computing	None	2
	6	IE-122	Engineering Management	(3-0-3)	Management Sciences	None	7
Total Credit Hours				(15-2-17)			

BS1-101–ISLAMIYAT

Contact Hours

Theory: 32

Lab: 00

Total: 32

Credit Hours

Theory: 02

Lab : 00

Total : 02

Knowledge Profile: WK1

Semester: 1st

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-101:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about Quran, Hadith, life of Holy Prophet (S.A.W), Holy Wars and Pillars of Islam	C1 (Knowledge)	The Engineers and Society (6)
2	To explain Islamic heritage, civilization, solution to humanitarian problems, oneness, and importance of honest character	C2 (Comprehension)	Ethics (8)
3	To practice ways for avoiding sins, and employ Sidq.	C3 (Application)	Ethics (8)

HEC COURSE CONTENT FOR BSI-101:

ISLAMIC STUDIES (For Muslims)

QURAN SHARIF, Fazail Quran (Importance of Quran) as the ultimate source of knowledge for the betterment of mankind. Importance of Sunnah, as practical demonstration of Al-Quran and Huqooq-ul-Ibaad. DEEN-E-ISLAM., Tauheed, Risalat and Aakherat for eternal peace of mankind. Concept of Rizk-e-Halal (verses from Al-Quran) and Professional Ethics in the light of Al-Hadith, Importance of Prayers, Fasting Zakat, Hajj and Jihad in professional performance. Uswatul Hassanah as vision for workplace and social environmental improvement. Learning from Makki and Madani life of Prophet Muhammad (SAWW) and Sahaaba as leadership and team for commitment and continuous improvement. Core policies behind Spreading of Islam تبلیغ اسلامand the application of Philosophical thoughts behind Mithaqe-Madina, میثاق مدینه Fateh-e-Mecca, فتح مکه and Hajjatul-vida حجة الوداع for regional and global relations. Islamic lawfulness, Heritage, Solutions to humanitarian problems, future, oneness, political solidarity as road map to civic civilization. Importance of honest character, practicing ways for avoiding of sins according to Islam. Application of Sidq.

GRADING POLICY FOR BSI-101

Sessional	:	25 %
Mid Term	:	25%
Final	:	50%

TEXT BOOKS FOR BSI-101

As decided by teacher

BSI-142 ENGLISH COMPOSITION AND COMPREHENSION

Contact Hours

Theory: 48

Lab : 00

Total : 48

Credit Hours

Theory: 03

Lab : 00

Total : 03

Knowledge Profile: WK3

Semester: 1st

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-142:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Practice English composition correctly in speaking and writing	C3	Communication (10),
2	Show sound vocabulary and critical thinking skills, to use English in formal situations	C2	Communication (10)

HEC COURSE CONTENT FOR BSI-142:

Basics of Grammar Parts of speech and use of articles Sentence structure, Active and passive voice Practice in unified sentence Analysis of phrase, clause and sentence structure Transitive and intransitive verbs Punctuation and spelling

Comprehension

Answers to questions on a given text

Discussion

3 (3,0)

General topics and every day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening

To be improved by showing documentaries/films carefully selected by subject teachers)

Translation skills

Urdu to English

Paragraph writing

Topics to be chosen at the discretion of the teacher

Presentation skills

Introduction

Note: Extensive reading is required for vocabulary building

GRADING POLICY FOR BSI-142:

Sessional	:	15 %
Mid Term	:	25%
Final	:	50%

TEXT BOOKS FOR BSI-142:

1. Effective Business Communication By Herta A. Murphy Seventh Edition.
2. Business Communication Principles and Applications. 2nd Edition. By C. Glen Pearce, Ross Figgins and Steven P. Golen.

Recommended Books:

a) Grammar

Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises. Third edition. Oxford University Press. 1997. ISBN 0194313492

Practical English Grammar by A. J. Thomson and A.V. Martinet. Exercises. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing 1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and

Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension 1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford

Supplementary Skills. Third Impression 1992. ISBN 0 19 453402

d) Speaking

BS1-122–CALCULUS

Contact Hours

Theory: 48

Lab: 00

Total : 48

Credit Hours

Theory: 03

Lab : 00

Total : 03

Knowledge Profile: WK2

Semester: 1st

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-122:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about different types of function, their graphs, limits, continuities, derivatives and integrations.	C1	Engineering Knowledge (1)
2	Describe the concept of differential calculus.	C2	Problem Analysis (2)
3	Apply calculus to the problems involving rate of change, optimization, area under and	C3	Design and Development of Solution (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	between the curves, volumes, are length and area of surface of revolution etc;		

HEC COURSE CONTENT FOR BSI-122:

Type of Functions (continues, periodic, odd, even, graphs of functions, Limits and continuity, Derivatives, total differential, Higher odder derivative, Tangents and normal, approximation by Taylor and Maclaurin's series, Maxima & Minima and Point of inflection, Integral Calculus (basic concepts, Integral formula, some rules of integral), Integration by parts, area bounded by curve, volume of revolution, Multivariate Calculus(Basic Concept, level curves and surfaces, limits and continuity), Partial Derivative, Higher order partial derivative, tangent plan, total differential, Vector functions its derivative and integration, Directional derivative, gradient, scalar and vector, Normal property of gradient, diversions, curl, Tangent plans and normal lines, extrema of function of two variables, Second partial test, extreme value theorem, Method of constrained optimization and Lagrange multiplier

GRADING POLICY FOR BSI-122:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR BSI-122:

1. Schaum's series, Complex, Schaum's series, (Latest Edition)
2. Antom, H. Calculus and Analytic Geometry, John Wiley and Sons. (Latest Edition)

ME 105 – ENGINEERING DRAWING

Contact Hours	**Credit Hours**
Theory : 48	**Theory : 03**
Lab : 00	**Lab : 00**
Total : 48	**Total : 03**
Knowledge Profile: WK4	**Semester: 1st**

COURSE LEARNING OUTCOMES (CLOS) FOR ME-105

CLO No.	Course Learning Outcomes (CLOs)	New Taxonomy Domain	PLOs Addressed by Course
1	To define basic concepts of engineering drawing.	C1	Engineering Knowledge (1)
2	To draw geometrical shapes and their constructions, orthographic projections of lines, planes and solids, drawing mechanical parts on drawing sheets	C2	Engineering Knowledge (1)

COURSE CONTENTS FOR ME-105:

Introduction. Types of lines, lettering, dimensioning, drawing instruments, planning of drawing sheet. Orthographic projections, plane of projections, projection of straight lines, traces of a line, true length of a line, inclination to both the planes, projection of oblique and auxiliary planes. Loci of Points and Generated Curves. Development of Solids. Intersection of Surfaces. Intersection of solids. Axonometric Projections. Types, Isometric projections of solids, planes, typical examples.

Projection in Auxiliary Planes. Auxiliary planes and views, projection of points, line, plane. Projection of Solids, development of surfaces.

RECOMMENDED BOOKS FOR ME-105:

1. Engineering Drawing and Graphics by T. E. French, C. J. Vierck, R. J. Foster

2. Practical Geometry & Engineering Graphics by Abbot.

3. Engineering Graphics by Craft, Meyers & Boyer

4. Engineering Drawing, by N.D. Butt

COURSE LEARNING OUTCOMES (CLOS) FOR ME-105 LAB:

CLO No.	Course Learning Outcomes (CLOs)	NEW Taxonomy Domain	PLOs Addressed by Course
1	To construct type of lines, lettering, dimensioning, instruments, drawing sheet, orthographic projections, auxiliary planes, oblique planes and isometric projections, insertion and Development, D&T	P7	Engineering Knowledge (1)
2	Practice of drawing knowledge to draw assembly, exploded views and layout drawings, P&ID, rivet, screws, threads, bolt and nuts, couplings, bearings, keys cotters, and pulleys.	P3	Engineering Knowledge (1),

COURSE CONTENTS FOR ME-105 LAB:

Lettering; Geometric constructions of engineering curves; Orthographic projections of various solids; Orthographic projections of machine elements such as nuts, bolts, threads, flanges, bearings, etc. Drawing of assemblies.

RECOMMENDED BOOKS FOR ME-105 LAB:

1. A C Parkinson, A First Year Engineering Drawing, Pitman.

2. F Giesecke, Technical Drawing, 12th ed, Prentice-Hall, 2003

IE-115 Introduction to computing

Contact Hours

Theory : 32

Lab : 48

Total : 80

Credit Hours

Theory : 02

Lab : 01

Total : 03

Knowledge Profile: WK2

Semester : 1st

COURSE LEARNING OUTCOMES (CLOS) FOR IE-115:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Know about computer hardware, software's, programming languages and communication networks	C1	Engineering Knowledge (1)
2	Practice word processing, spread sheet, presentation software's, and different programming languages	C3	Modern Tool Usage (5)

HEC COURSE CONTENT FOR IE-115:

Introduction to computer hardware and software, Word processing programs, Spreadsheets programs, Equation solvers and procedural computations, Communication and networking. Constants and variables, Arithmetic operations, Intrinsic functions, Algorithm design, Flowcharts, and Pseudo codes, IF statements, Do loop, While loop, Data files, Formatted Input and Output,

Logical and character data type, Arrays: one-dimensional, two-dimensional, Subprograms: Functions and subroutines, Numerical Applications, Introduction to programming language

GRADING POLICY FOR IE-115:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-115:

1. Programming with C++ by Dietel
2. Visual basic by Mathew McDonald,
3. Microsoft Visual Basic 2010 Step by Step by Michael Halvorson, Microsoft Press
4. Fortran 90/95 for Scientists & Engineers by Stephan J. Chapman
5. MATLAB for Engineers by Holly Moore, Prentice Hall
6. An Engineers guide to MATLAB by Edward B. Magrab, Pearson Education

LIST OF PRACTICAL FOR IIE-115L

S.No.	Practical
1	Introduction to MATLAB
2	Basic MATLAB Arithmetic Operations (Expression)
3	Study of Basic Matrix Operations
4	Relational and Logical Operations
5	Polynomial Operation

S.No.	Practical
6	To solve linear equation
7	Solution of Linear Equations For Underdetermined and Over determined Cases
8	To determine Solution of Difference Equations
9	Plotting Function
10	Flow Control
11	C- Language Programming
12	Presentations
13	C- Language Programming
14	Presentations
15	Input / Output variables using in MATLAB
16	ASCII Codes

LAB CLOS FOR IE-115:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	Practice functions, arrays and loops of MATLAB and C++	P3	Modern Tool Usage (5)

IE-122-ENGINEERING MANAGEMENT

Contact Hours

Theory : 48

Lab : 00

Total : 48

Knowledge Profile: WK7

Credit Hours

Theory : 03

Lab : 00

Total : 03

Semester : 1st

COURSE LEARNING OUTCOMES (CLOS) FOR IE-122:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	**Know** the basic management functions, planning & decision making of organizations by applying engineering management concepts **(knowledge)**	C1	Engineering Knowledge (1)
2	**Explain** organizational structures, tools for developing solutions, human aspects of management and describe elements to control them (**compréhension)**	C2	The engineer and society(6)
3	**Analyze** the market and new business ideas select methods to motivate and lead technical people **(analysis)**	C4	The engineer and society(6)

HEC COURSE CONTENT FOR IE-122:

The vision and mission of management, The management process and strategy, Strategic management, The planning process, Organization structures, Human factors, Motivation & leadership, Basics elements of control, Managing, designing and new product development, Managing the supply systems, Marketing, introduction to entrepreneurship.

GRADING POLICY FOR IE-122:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR IE-122:

1. Managing Engineering and Technology by Babcock and Morse, Prentice Hall
2. Management by Herald Koontz

SCHEME OF STUDIES FOR 2ND SEMESTER

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
2	1	BSI-143	Presentation and Communication Skills	(3-0-3)	Humanities	None	
	2	BSI-231	Differential Equations	(3-0-3)	Natural Sciences	None	
	3	BSI-111	Applied Linear Algebra	(3-0-3)	Natural Sciences	None	
	4	BSI-181	Applied Physics	(2-1-3)	Natural Sciences	None	
	5	BSI-110	Pak Studies	(2-0-2)	Humanities	None	
	6	IE-121	Workshop Practice	(0-2-2)	Engineering Foundation	None	—
Total Credit Hours				(14-3-17)			

BSI-143 Presentation and Communication Skills

Contact Hours

Theory: 48

Lab : 00

Total : 48

Credit Hours

Theory: 03

Lab : 00

Total : 03

Knowledge Profile: WK7

Semester: 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-143:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Practice translations, official letters, memorandums, essay writing, and reports and also be able to produce these documents in a professional manner	C3	Communication (10)
2	Demonstrate communicative activities on the learned rules	C5	Communication (10)

HEC COURSE CONTENT FOR BSI-143:

Paragraph writing

Practice in writing a good, unified and coherent paragraph

Essay writing

Introduction

CV and job application Translation skills

Urdu to English

Study skills

Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills

Letter / memo writing and minutes of the meeting, use of library and internet recourses

Presentation skills

Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

GRADING POLICY FOR BSI-143:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR BSI-143:

1. Effective Business Communication By Herta A. Murphy Seventh Edition.
2. Business Communication Principles and Applications. 2nd Edition. By C. Glen Pearce, Ross Figgins and Steven P. Golen.

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing

Writing.IntermediatebyMarie-ChrisitineBoutin,SuzanneBrinandand Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking). Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

Reading and Study Skills by John Langan

Study Skills by Richard Yorky.

BSI-231 Differential Equations

Contact Hours

Theory: 48

Lab : 00

Total : 48

Credit Hours

Theory: 03

Lab : 00

Total : 03

Knowledge Profile: WK2

Semester: 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-231:

CLO NO.	Course learning outcomes	Taxonomy Domain	Program Learning Outcomes
1	To know about various types of differential equations and their solution procedures.. (Knowledge)	C1	Engineering Knowledge (1)
2	Describe concepts of equations, differential equations, and partial differential equations.	C2	Problem Analysis (2)
3	To solve different types of differential equations by understanding fundamental methods and techniques	C3	Design and Development of Solution (3)

HEC COURSE CONTENT FOR BSI-231:

Basic concepts of ordinary differential equation, General and particular solutions, Initial and boundary conditions, Linear and nonlinear differential equations, Solution of first order differential equation by separable variables and its applications in our daily life situations, The techniques like change of variable, homogeneous, non homogeneous, exact, non-exact, linear and nonlinear Bernoulli could be used in case of complications. Solution of second order differential equation by theory of operators and its applications as forced and free oscillations, The extension of second order solution criteria to higher order differential equations, Solution of the system of differential equations by theory of operators and its applications in our daily life situations, Laplace solution of ordinary differential equations.

Partial Differential Equations:

Basic concepts, Linear and nonlinear p.d. equations, Quasi linear and Quasi nonlinear p.d. equations, Homogeneous and non-homogeneous p.d. equations, Solutions of p.d. equations, Boundary and initial conditions as Dirichlet condition, Neumann condition, Robbins/Mixed condition, Classification of p.d. equations as Elliptic, Parabolic and Hyperbolic.

Analytic solution by separation of variables of the Steady-state Two-Dimensional Heat equation/Laplace equation and Unsteady-State One-Dimensional Heat equation/Diffusion equation with homogeneous and non homogeneous boundary conditions. D' Alembert's solution of two-dimensional wave equation with homogeneous and non homogeneous boundary conditions.

Fourier series:

Periodic waveforms and their Fourier representations, Calculating a Fourier series, Fourier series of odd and even functions, half range Fourier series, Fourier series solution p.d. equations.

GRADING POLICY FOR BSI-231:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

RECOMMENDED BOOKS:

1. Differential Equations by Abell and Braselton, McGraw-Hill
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw-Hill
3. Ervin and Kreyszig, E. Advanced Engineering Mathematics, John Wiley and Sons, (Latest Edition).
4. Speigal M. R., Theory and Problems of Laplace Transforms, Schaum's Outline Series.

BSI-111 APPLIED LINEAR ALGEBRA

Contact Hours

Theory: 48

Lab : 00

Total : 48

Credit Hours

Theory: 03

Lab : 00

Total : 03

Knowledge Profile: WK2

Semester: 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-111:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about the systems of equations	C1	Engineering Knowledge (1)
2	To describe different concepts of linear algebra, matrices and linear transformation	C2	Problem analysis (2)
3	To solve engineering and science problems with the help of systems of equations.,	C4	Design/development of solutions (3)

HEC COURSE CONTENT FOR BSI-111:

Vector Algebra, Matrix Algebra, Determinants, Linear System of Equations, Linear Transformations, Eigen-values and Eigenvectors

GRADING POLICY FOR BSI-111:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR BSI-111:

Linear Algebra and its Applications by David C Lay, Addison-Wesley

BSI-181 Applied physics

Contact Hours

Theory: 32

Lab : 48

Total : 80

Credit Hours

Theory: 02

Lab : 01

Total : 03

Knowledge Profile: WK1

Semester: 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-181:

CLO NO	Course learning outcomes	Taxonomy Domain	Program Learning Outcomes
1	Describe the laws and principle of physics	C2	Engineering Knowledge (1)
2	Apply laws and principle of physics mentioned in course content	C3	Problem Analysis (2)

HEC COURSE CONTENT FOR BSI-181:

Vectors and Scalars, Motion along a Straight Line, Work and Energy, Impulse and momentum, Coulomb's Law, Electric Field, Electrical Potential, Capacitance and Dielectrics, Current, Resistance and Electromotive Force, Magnetic Field and Magnetic Forces, Isotopes and mass spectroscopy, Sources of Magnetic Field, Induction Phenomenon, Motional electromotive force, Faraday's Law, Lenz's Law, Eddy Currents.

GRADING POLICY FOR BSI-181:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR BSI-181:

1. University Physics by Sears, Zemansky and Young, Addison-Wesley, Publication Company.
2. Fundamentals of Physics, 5th Edition by Halliday, Resnick and Walker

LIST OF PRACTICAL FOR BSI-181

S.No	Practical
1	Determine the resistance of a Galvanometer by Kelvin method.
2	Convert a Galvanometer into an Ammeter.
3	Convert the galvanometer in to voltmeter.
4	To determine the given high resistance by leakage method.
5	Study Variation of Resistance in Metal & semiconductor.
6	Calibrate the thermocouple by deflection method.
7	Find the frequency of A.C Main by Sonometer.
8	Verify KVL and KCL.
9	To study the variation of Photoelectric current with intensity of incident beam.
10	To determine the angle of dip by earth inductor method.
11	To determine the value of a given resistance by colour coding.
12	To study Ohm's law.

Lab CLOs for BSI-181:

CLO NO	Course learning outcomes	Taxonomy Domain	Program Learning Outcomes
3	Practice, basic circuit design, measurement of different quantities using laws of physics.	P3	Investigation (4)

BSI-110 PAKISTAN STUDIES

Contact Hours

Theory : 32

Lab :00

Total : 32

Credit Hours

Theory : 02

Lab : 00

Total : 02

Knowledge Profile: WK3

Semester : 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-101:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about Pakistan's historical perspective, geo location, constitutional phases, contemporary affairs, and future challenges	C1	The Engineers and Society (6)
2	To summarize major events and life of prominent personalities related to Pakistan.	C5	The Engineers and Society (6)
3	To assess national institutions, social issues, Ethincity, Foerign policy and future challenges.	C6	The Engineers and Society (6)

HEC COURSE CONTENT FOR BSI-101:

Historical Perspective

Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.

Factors leading to Muslim separatism

People and Land

Indus Civilization

Muslim advent

iii. Location and Geo-Physical features.

Government and Politics in Pakistan Political and constitutional phases: 1947-58, 1958-71, 1971-77, 1977-88, 1988-99, 1999 onward

Contemporary Pakistan Economic institutions and issues, Society and social structure, Ethnicity, Foreign policy of Pakistan and challenges, Futuristic outlook of Pakistan

GRADING POLICY FOR BSI-101:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR BSI-101:

1. Effective Business Communication By Herta A. Murphy Seventh Edition.
2. Business Communication Principles and Applications. 2nd Edition. By C. Glen Pearce, Ross Figgins and Steven P. Golen.

IE-121- WORKSHOP PRACTICE

Contact Hours

Theory: 00

Lab : 96

Total : 96

Credit Hours

Theory : 00

Lab : 02

Total : 02

Knowledge Profile: WK6

Semester: 2nd

COURSE LEARNING OUTCOMES (CLOS) FOR IE-121:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Identify the safety procedures in workshop.	C1	Engineering Knowledge (1)
2	Demonstrate the use of measuring tools used in various shops in the workshop.	C3	Modern Tool Usage (5)
3	Execute the operations involved in different shops.	P4	Individual and Team Work (9)

HEC COURSE CONTENT FOR IE-121:

Basic Processes in Fitter Shop, Bench-fitting practice; Exercise in marking and fittings, Basic Processes in Wood Work Shop, Use of carpenter's tools; Exercises in preparing simple joints; Use of measuring instruments. Basics of Electric Shop, Functions of Forge & Foundry Shop, Machine Shop, Soldering, Brazing and Welding. Smith's forge; Exercise in bending, upsetting and swage. Heat treatment, Moulding and casting. Simple machine shop processes, such as turning, shaping, milling, Introduction to CNC Machines.

GRADING POLICY FOR IE 121:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-121:

1. Workshop Technology Part-1 by W. A. J. Chapman, McGraw-Hill
2. Metal Work by LUDWIG
3. Manufacturing Processes by Ostwald

LIST OF PRACTICAL FOR IE-121

Week	Practical
1	Introduction to Pattern Shop, To make a T-Lap Joint, To make a half cross Joint
2	To make a lap dove tail joint, To make a pattern Bearing Bracket
3	Plain Turning on lathe machine, Facing operation on lathe machine
4	To perform a drill and boring operation on center lathe machine. To make a bolt and V shape thread on centre lathe machine
5	Introduction to slotting and Universal grinding machine. To make a rectangular slot on milling machine. To shape a hexagon from a round bar on shaper machine

Week	Practical
6	Two lights controlled by one switch in series. One light controlled by two way switches
7	A bulb and two pin wall socket controlled by two switches. Hotel wiring or indicator circuit
8	To forge a half inch square from a round piece of mild steel. To make a square rod
9	To forge a wall hook from mild steel rod. To make an S hook
10	To weld a butt joint by electric arc welding. To weld a corner joint by electric arc welding. To weld a lap joint of sheets by spot welding.
11	To weld a T joint by Oxy-Acetylene welding, Soldering
12	To make mold of green sand with the help of rectangular pattern
13	To make a mold of bearing bracket
14	Casting, To make a rectangular radius job
15	To perform drilling and reaming. To make a V-shape thread bolt external and internal. V-Fitting

SCHEME OF STUDIES FOR 3RD SEMESTER:

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
3	1	BSI-351	Probability and Statistics	(3-0-3)	Natural Sciences	Calculus	2
	2	IE-234	Basic Industrial Engineering	(2-0-2)	Engineering Foundation	None	3
	3	IE-235	Materials Engineering	(3-1-4)	Engineering Foundation	None	4
	4	IE-242	Mechanical Technology	(3-1-4)	Major Based Core (Breadth)	None	
	5	IE-237	Mechanics of Materials	(3-1-4)	Engineering Foundation	Materials Engineeirng	5
Total Credit Hours				(14-3-17)			

BSI-351-Probability and Statistics

Contact Hours	Credit Hours
Theory: 48	**Theory: 3**
Lab : 0	**Lab : 0**
Total : 48	**Total : 3**
Knowledge Profile: WK2	**Semester: 3rd**

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-351:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To discuss different methods and concepts use for the organization and description of a numerical data set. **(Comprehension)**	C2	Problem Analysis (2)
2	To apply different concepts such as measure of central tendency, dispersion, regression, and probability distribution. **(Applications)**	C3	Investigation (4)
3	To defend the decision taken on the basis of statistical techniques. **(Evaluation)**	C6	Design and Development of Solution (3)

HEC COURSE CONTENT FOR BSI-351:

Measures of central tendency and dispersion, Moments, Introduction to classical Probability theory, Bayes theorem, Random variables (discrete and continuous), Probability distributions (Normal, Binomial, Poisson etc.), Expectation, Conditional distribution and conditional expectations, Correlation and regression.

GRADING POLICY FOR BSI-351:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR BSI-351:

1. Introduction to statistical theory part 1 Written by Sher Muhammad Chaudhary
2. Advance Engineering mathematics Written by Erwin Kreyszing Tenth edition.

IE 234-Basic Industrial Engineering

Contact Hours	Credit Hours
Theory: 32	**Theory: 2**
Lab : 0	**Lab : 0**
Total : 32	**Total : 2**
Knowledge Profile: WK3	**Semester: 3rd**

COURSE LEARNING OUTCOMES (CLOS) FOR IE-234:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know the basic concepts of industrial and systems engineering. Able to define performance measures in systems. (knowledge)	C1	Engineering knowledge (1),
2	To be able to have basic understanding of Industrial engineering study areas such as project management, layouts, work methods, environment, quality control, optimization, and operations planning. (comprehension)	C2	Engineering Knowledge (1),
3	To be able to solve basic level problems related to various industrial engineering study areas. (Application)	C3	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR IE-234:

Introduction to Industrial Engineering topics including, Project Management, Strategic IE decisions (product, process, location, layout), and tactical IE decisions (production, inventory, scheduling, and quality). Works and methods study. Awareness related to International Standards related to quality and environment, Environmental balance – Types of pollution (air, water and soil pollution), Environmental impact of Engineering and Industrial activities, introduction to CBAs (collective bargaining agents)

GRADING POLICY FOR IE-234:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-234:

1. Introduction to Industrial and Systems Engineering by Tuner, Mize, Case and Nazemetz.
2. Operation Management by Heizer, Render and Rajashekar.
3. Environmental Science: Towards a sustainable future by Wright and Broose.
4. Environmental Science: Science, Principles and Practices by Das and Behera.

IE 235 - MATERIALS ENGINEERING

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK4

Semester : 3rd

COURSE LEARNING OUTCOMES (CLOS) FOR IE-235:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about engineering materials, their types, classification of materials and their structure. **(Comprehension)**	C1	Engineering knowledge (1)
2	To analyze the structure, mechanical and physical properties of materials, outline their applications **(Analysis).**	C4	Problem analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To evaluate properties of engineering materials, categorize heat treatment process and able to outline their environmental effects. **(Evaluation).**	C6	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-235:

Types of materials, crystalline & amorphous materials, Solid solutions and phase diagrams, application of materials. Ferrous and Non-Ferrous Metals and alloys, their major properties and their heat treatment. Ceramics, Glasses, Rubbers & Refractory Materials, Polymers, Composites, Environmental Degradation, corrosion. Indigenous materials.

GRADING POLICY FOR IE-235:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

Text Books:

Materials Science and Engineering by William F. Smith Javad Hashemi Ravi Prakash

RECOMMENDED BOOKS FOR LAB IE-235:

The Science and Engineering of Materials by Donald R. Askeland Fundamentals of Modern Manufacturing by Mikell P. Groover

LIST OF PRACTICAL FOR IE-235

S.No	Practicals
1	To Familiarize Students with the Safety Rules and Equipment in the Material and Surface Engineering Laboratory
2	Introduction of Universal Testing Machine (UTM) UH-500KNI
3	Introduction of Trapezium2 Software for Universal Testing Machine (UTM) UH-500KNI
4	Introduction of Tensile Test of Steel using Universal Testing Machine (UTM) UH-500KNI
5	Introduction of Compression Test of Block using Universal Testing Machine (UTM) UH-500KNI
6	Performing Bending Test on Steel using Universal Testing Machine (UTM) UH-500KNI
7	X-Ray Diffractometer (introduction)
8	Introduction to Software
9	X-Ray Diffractometer (Experiment)
10	To find impact energy
11	To measure creep mechanism of material
12	Brinell Hardeness test
13	Vickers Light load hardness test
14	To determine the impact strength through charpy test.
15	Rockwell harness test
16	Fatigue test

COURSE LEARNING OUTCOMES (CLOS) FOR LAB IE-235:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Conduct different tests on materials and produce results	P4	Modern tool usage (5),
5	To operate under supervision various equipment	P3	Modern tool usage (5)

IE242– Mechanical Technology

Contact Hours

Theory: 48

Lab : 48

Total : 96

Credit Hours

Theory: 03

Lab : 01

Total : 04

Knowledge Profile: WK6

Semester: 3rd

COURSE LEARNING OUTCOMES (CLOS) FOR IE-242:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To be able to recognize the role of Mechnical Technology in industry	C1	Engineering knowledge (1)
2	To be able to illustrate basic concepts of Mechanical Engineering including Thermodynamics, Fluid Mechanics, Machine Design and Airconditioning & Refrigeration	C2	Engineering knowledge (1)
3	To be able to apply basic formulae of mechanical engineering for calculation of various efficiencies, power generation and transmission in cycles and air-conditioning	C3	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

COURSE CONTENT FOR IE-242:

Introductory concepts & definitions, using energy and the laws of thermodynamics, , First Law and Second Law of thermodynamics, Air Cycles, Carnot's Cycle, The otto cycle, Diesel Cycle, and refrigeration systems,. Working of Elements of Mechanical Power Transmission , Modes of heat transfer and their equations, basic concepts of cooling load calculation, Fluids and their properties, Fluid Statics, Pressure measurement: Bourdon pressure gauge, Manometers,. Kinematics of fluid flow: Laminar and Turbulent flow, continuity and Bernoulli's Equation, Flow through pipes: Moody Charts. Introduction to hydraulic machinery.

GRADING POLICY FOR IE-242:

Sessional : 15 %

Mid Term : 15 %

Final : 50 %

RECOMMENDED BOOKS FOR IE: 242:

1. Thermodynamics – An Engineering Approach by Yunus A. Cengel and Michael A. Boles, 5th Edition
2. Fundamentals of Engineering Thermodynamics by Michael J. Moran and Howard N. Shapiro
3. Introduction to thermal systems engineering: Thermodynamics, fluid Mechanics and heat transfer by Michael J. Moran, Howard N. Shapiro, Bruce R. Munson.

4. Fundamentals of Fluid Mechanics by Bruce R. Munson, Donald F. Young and Theodore H. Okiishi

List of Practical for IE-242

S.No.	List of Practical
1	Demonstration of main components of IC engine
2	Differential pressure measurements using various manometers
3	Demonstration of Ignition system of IC petrol engine
4	Reynolds experiment (laminar and turbulent flow)
5	Demonstration of cooling systems of IC engines
6	Demonstration of fuel system of IC petrol engine
7	Flow measurement with Venturi meter
8	Demonstration of power transmission systems of a car
9	Demonstration of automobile brake system
10	Flow from orifice in the side of a tank (Bernoulli's Equation)
11	Conductive and convective heat transfer rate calculations
12	Demonstration of refrigeration system
13	Demonstration of working of Power plants

LAB CLOS FOR IE-242:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To be able to demonstrate working of mechanical systems and communicate them.	P4	Engineering Knowledge (1)

IE 237- MECHANICS OF MATERIALS

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK5

Semester : 3rd

COURSE LEARNING OUTCOMES (CLOS) FOR IE-237:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Know the theory based concept of mechanics of deformable bodies, stress, strain, deformation, , torsion, bending, and failure criteria.	C1	Engineering Knowledge (1)
2	Calculate the shear, torsional, axial, and bending stresses which occur at a point or which act on a section, and express this state of stress either algebraically or graphically using Mohr's Circle for Stress	C3	Engineering Knowledge (1)
3	To analyze deflection, angle of twist, power transformation in circular shafts, yield and failure criteria of materials	C4	Problem Analysis (2)

HEC COURSE CONTENT FOR IE-237:

Mechanics of Deformable Bodies, Deformation, Strain, General stress-strain relationships, Elastic load-deformation behavior of materials, Lateral strain, Thermal strain, Bending: Pure bending, Moment-curvature Relationship, Beam Deflection; Torsion and Twisting, Energy Methods, Stress and strain transformations, Mohr s stress/strain circle, Stress and strain transformation in composites, Yield and failure criteria of materials.

GRADING POLICY FOR IE-237:

Sessional : 25 %

Mid Term : 25 %

Final : 50%

TEXT BOOKS FOR IE-237:

1. Mechanics of Material. Beer, Johnson and Dewolf,
2. Hibbeler, R. C. Mechanics of Materials. 6th Ed. East Rutherford, NJ: Pearson Prentice Hall

List of Practical

S. No	List of Practical
1	Introduction to Mechanics of Materials Lab, its necessary equipment and the standard rules and regulations governing this lab.
2	Resolve, by experiment, any suitable combination of three static, co-planar forces and then to compare the results with the graphical solution obtained by drawing a triangle of forces diagram.
3	Study relationship between force and extension produced in an extension spring.
4	Determination of the friction coefficient for different materials combinations.
5	Determination of fractional force on inclined plane at 30 degrees inclination.
6	Determine how torque and material type effect torsional deflection.

S. No	List of Practical
7	Investigate the Principal of moments using junior mechanism kit.
8	Determine the relationship between the rotation of the crank and movement of the slide by quick return mechanism.
9	Determine relation between centrifugal force (F), mass (m) of rotating body, its distance from axis (r) and its angular velocity (w).
10	Determine relation between the parameters of centrifugal force i.e. mass (m) of rotating body, its distance from axis (r) and its angular velocity (w).
11	Investigation of gyroscopic couple direction.
12	Determine magnitude of gyroscopic couple.
13	Compare experimental and theoretical values of the reactions due to point loads on beams.
14	Determination of bending moment profile “My(X)” and shear force profile Qz (X) of a beam when subjected to central loading with a concentrated load.
15	Determination of bending moment profile “My(X)” and shear force profile Qz (X) of a beam when subjected to symmetrical loading with two concentrated forces.
16	Determine the relationship between the angular acceleration of a flywheel and the torque producing the acceleration.

COURSE LEARNING OUTCOMES (CLOS) FOR LAB OF IE-237:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Operate under supervision different tools of mechanics of materials	P3	Modern tool usage (5)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
5	Show dexterity in using different mechanics tools	P4	Individual and team work (9)

GRADING POLICY FOR LAB OF IE-237:

Sessional : 25 %

Mid Term : 25 %

Final Term : 50 %

Scheme of Studies for 4th Semester

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
4	1	IE-241	Engineering Economics	(3-0-3)	Humanities	None	
	2	IE-236	Introduction to Computer Aided Design	(3-1-4)	Engineering Foundation	Engineering Drawing-I	
	3	IE-243	Logical and Critical Thinking	(3-0-3)	Humanities	None	
	4	IE-244	Manufacturing Processes	(3-1-4)	Major Based Core (Breadth)	Workshop Practice	
	5	IE-248	Technical Writing and Comprehension	(3-0-3)	Humanities	None	
Total Credit Hours				(15-2-17)			

IE 242– ENGINEERING ECONOMICS

Contact Hours

Theory : 48

Lab : 0

Total : 48

Credit Hours

Theory : 3

Lab : 0

Total : 3

Knowledge Profile: WK7

Semester: 4th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-242:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about the fundamental concepts and terminology used in engineering economics.	C1	Engineering Knowledge (1)
2	Use engineering economy factors to account for time value of money	C3	Problem Analysis (2)
3	To evaluate the cost effectiveness of alternatives using the engineering economy methods and draw inferences for the investment decisions.	C6	Design and Development of Solution (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR IE-242:

Introduction to engineering economics, Micro and macroeconomics, Break even analysis, Balance sheet, Cost and investment analysis, Basis for comparison of alternatives, Time value of money, Decision making in present economy, Evaluating replacement alternatives, Cash flow, Interest formulas and equivalence, Depreciation, Economic analysis of operations, Economic analysis of projects.

GRADING POLICY FOR IE-242:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-242:

Engineering Economy by Leland Blank, Anthony Tarquin

RECOMMENDED BOOKS FOR IE-242:

Fundamentals of Engineering Economics (2^{nd} Edition) by Chan S. Park, Pearson Education.

Engineering Economy (15^{th} Edition) by William G. Sullivan, Elin M. Wicks and C. Patrick Koelling, Pearson Education

Financial and Cost Analysis of Engineering & Technology Management by H. Riggs, Jhon Wiley

IE-236 INTRODUCTION TO COMPUTER AIDED DESIGN

Contact Hours

Theory: 48

Lab : 48

Total : 96

Credit Hours

Theory: 03

Lab : 01

Total : 04

Knowledge Profile: WK5

Semester: 4th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-236:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To be able to identify manufacturing drawings in respect of dimensioning, tolerances, section views	C1	Engineering Knowledge (1)
2	Construct geometries with the principles of engineering drawings.	C3	Engineering Knowledge (1)
3	Interpret geometric dimensioning and Tolerances in manufacturing industries	C2	Design and Development of Solution (3)
4	Classify different types of Fasteners used in industries.	C4	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-236:

Introduction to geometric dimensioning and tolerances on engineering drawings for manufacturing and assembly operation, assembly and layout drawings. Introduction to tolerances for geometric features like straightness, flatness, circularity, cylindricity, parallelism, symmetry, rivets and riveted joints, screws, threads, bolts and nuts, couplings, bearings, keys and cotters, pulleys, and computer aided drafting.

GRADING POLICY FOR IE-236:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS

1. Engineering Drawing and Graphics by T. E. French, C. J. Vierck, R. J. Foster
2. Practical Geometry & Engineering Graphics by Abbot.
3. Engineering Graphics by Craft, Meyers & Boyer

List of Practical for IE-236

S. No	List of Practical
1	CAD overview (Geometric modeling)
2	Title bar / Template develoment and usage
3	Setting up scale / daigonal scale and page size
4	2D views / orthographic projection (3rd angle)
5	Isometric / Oblique projection

S. No	List of Practical
6	Cross section and detail views
7	3D Constructive solid geometry (CSG)
8	CSG by B-Rep Method
9	CSG by primitives
10	CSG by revolution
11	Feature based solid modeling
12	3D fillet, chamfer and shell feature
13	Tabulated surface
14	Revolved surface
15	Ruled surface
16	Assembly modeling

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-236:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
5	Demonstrate drawing Skills using CAD softwares	P4	Modern Tool usage (5)

IE-234- LOGICAL AND CRITICAL THINKING

Contact Hours

Theory: 48

Lab : 0

Total : 48

Credit Hours

Theory: 03

Lab : 0

Total : 03

Knowledge Profile: WK7

Semester: 4th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-234:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To discuss relationship between language and reasoning, and to define and clarify the expressions.	C2	Engineering Knowledge (1)
2	To distinguish between Deductive and inductive reasoning, classify the relevant criteria or the evaluation of each kind of reasoning and differentiate formal and informal logical fallacies	C4	Investigation (4)
3	The ability to evaluate evidence, Reliable sources and other information relevant to the support of conclusions of reasoning. (Evaluate)	C6	Investigation (4)

HEC COURSE CONTENT FOR IE-234:

The Power of Critical Thinking, Claims and Reasons, Reasons and Arguments, Arguments in the Rough.

The Environment of Critical Thinking Perils of Haunted Mind, Self and the Power of the Group, Subjective and Social Relativism, Skepticism

·Making Sense of Arguments, Arguments Basics, Patterns, Diagramming Arguments, Assessing Long Arguments, Reasons for Belief and Doubt o Conflict Experts and Evidence, Personal Experience, Fooling Ourselves

Claims in the News, Faulty Reasoning, Irrelevant Premises, Genetic Fallacy, Composition, Division, Appeal to the Person, Equivocation, Appeal to Popularity, Appeal to Tradition, Appeal to Ignorance, Appeal to Emotion, Red Herring, Straw Man

Unacceptable Premises, Begging the Question, False Dilemma, Slippery Slope, Hasty Generalization, Faulty Analogy

Deductive Reasoning: Propositional Logic o Connectives and Truth Values, Conjunction, Disjunction, Negation,

Conditional, Checking for Validity, Simple Arguments, Tricky Arguments, Streamlined Evaluation, Deductive Reasoning: Categorical Logic o Statements and Classes, Translations and Standard Form, Terms, Quantifiers, Diagramming Categorical Statements, Sizing up Categorical Syllogisms

Inductive Reasons o Enumerative Induction, Sample Size, Representativeness, Opinion Polls, Analogical Induction, Casual Arguments, Testing for Causes, Casual Confusions

Inference to the Best Explanation o Explanations and Inference, Theories and Consistency, Theories and Criteria, Testability, Fruitfulness, Scope, Simplicity, Conservatism

Judging Scientific Theories o Science and Not Science, The Scientific method, Testing Scientific Theories, Judging Scientific Theories, Copernicus versus Ptolemy, Evolution Versus Creationism, Science and Weird Theories, Making Weird Mistakes, Leaping to the Weirdest Theory, Mixing

What Seems with What is, Misunderstanding the Possibilities, Judging Weird Theories, Crop Circles, Talking with the Dead

GRADING POLICY FOR IE-234:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR IE-234:

1. Vaughn Lewis, 2005, The Power of Critical Thinking, Oxford University Press.
2. Paulsen David W., Cederblom Jerry: 2000, Critical Reasoning, Wadsworth
3. Restall Greg. 2005, Logic: An Introduction, Routledge

IE-244-MANUFACTURING PROCESSES

Contact Hours

Theory: 48

Lab : 48

Total : 96

Credit Hours

Theory: 03

Lab : 01

Total : 04

Knowledge Profile: WK6

Semester: 4th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-244:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To be able to know basic concepts of various manufacturing processes	C1	Engineering Knowledge (1)
2	To be able to recognize the strong interrelationships between material properties and manufacturing processes	C2	Engineering Knowledge (1)
3	To be able to apply basic formulae for calculation of various process parameters	C4	Problem Analysis (2)

HEC COURSE CONTENT FOR IE-244:

Basic concepts of manufacturing processes, Casting processes, Furnaces, Forming and Joining processes, Welding, Brazing and soldering, Adhesive bonding, Traditional and non-traditional machining operations, capabilities and limitations, Rapid prototyping operations, Manufacturing of parts using polymer, composite and powder metallurgy, Process selection

GRADING POLICY FOR IE-244:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-244:

1. Manufacturing Engineering Processes by L. Alting, Marcel Dekker
2. Material & Processes in Manufacturing by Paul De Garmo, Black and Kohser, Prentice Hall
3. Materials and Designs: The art and science of material selection in product design by M. F. Ashby and K. Johnson, Butterworth and Hienmann.
4. Fundamentals of Modern Manufacturing: Materials, processes and systems by M. P. Groover, John Wiley.

List of Practical for IE-244

S. No	List of Practicals
1	Introduction to safety and Precautions
2	To Make a split pattern in Pattern Shop
3	To make a mold of split pattern using core
4	To cast a hollow piece by sand casting process

S. No	List of Practicals
5	To observe chip formationin Machine Shop
6	Compare casting and turning operation by visual inspection of same sahpe formed by both the processes
7	Compare brazing and soldering fusion welding processes
8	To observe Oxy-Acetylene Welding process and its parameters
9	Arc Welding Process
10	Forging Operation
11	To compare forging and machine operation by experiment
12	To create ductility and brittleness in two different parts and use UTM for material testing
13	Rapid prototyping process
14	Traditional machining process
15	Non Traditional Machining process

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-244:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To be able to demonstrate the concepts of manufacturing processes	P4	Investigation (4)

IE248– TECHNICAL WRITING AND COMPREHENSION

Contact Hours

Theory : 48

Lab : 0

Total : 48

Credit Hours

Theory : 03

Lab : 0

Total : 03

Knowledge Profile: WK8

Semester : 4th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-248:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To Know the attributes of Technical Writing and write covering letters, emails etc. for job and research grants (knowledge)	C1	Communication (10)
2	To interpret and practice technical writing and reading for graphs, tables, figures and process diagrams etc. (Application).	C3	Communication (10)
3	To document and present research article, research proposals, reports and thesis. (Synthesis).	C5	Communication (10)

HEC COURSE CONTENT FOR IE-248:

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content,

language, form, clarity, consistency)

Technical Report writing

Progress report writing and presentation

GRADING POLICY FOR IE-248:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR IE-248:

1. 'Engineers Guide to Technical Writing" by K G Budinski

Scheme of Studies for 5th Semester

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
5	1	BSI-242	Numerical Analysis	(3-0-3)	Natural Sciences	Intro. To Computing and Probability and Statistics	
	2	IE-353	Metrology and Statistical Quality Control	(3-1-4)	Engineering Foundation	Probability and Statistics	
	3	IE-352	Manufacturing Systems	(3-1-4)	Major Based Core (Depth)	Manufacturing Processes	5
	4	IE-356	Operation Research	(3-1-4)	Engineering Foundation	Applied Linear Algebra	4
	5	IE-355	Work Study and Methods Engineering	(2-1-3)	Major Based Core (Breadth)	Manufacturing Processes	5
Total Credit Hours				(14-4-18)			

BSI-242–NUMERICAL ANALYSIS

Contact Hours

Theory: 48

Lab : 0

Total : 80

Credit Hours

Theory: 03

Lab : 0

Total : 03

Knowledge Profile: WK6

Semester: 5th

COURSE LEARNING OUTCOMES (CLOS) FOR BSI-242:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe different numerical techniques in interpolation, differentiation, integration, eigenvalues and solution of algebraic and differential equations	C2	Engineering Knowledge (1)
2	To apply numerical methods on engineering and science problems	C3	Problem Analysis (2)
3	Determine and interpret solutions obtained via numerical methods	C6	Design and development of solutions (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR BSI-242:

Finite differences and operators form, Interpolation and extrapolation; Lagrange's interpolation, Numerical differentiation based on differences, Numerical integration: Trapezoidal and Simpson's approximations, Romberg integration process, Numerical Solution of non-linear equations; Bracketing and iteration methods, Direct solution of system of linear equations; Gausselimination, Direct and indirect factorization, symmetric factorization, tri diagonal factorization, Iterative methods like Jacobi's iteration and Gauss-Seidel iteration, Single and Multi-step methods, Higher order differential equations, System of differential equations, Numerical solution of linear and nonlinear boundary value problems.

GRADING POLICY FOR BSI-242:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR BSI-242:

1. Numerical Methods for Engineering, Science and Mathematics by Mumtaz Khan
2. Ordinary & Partial Differential Equations with Numerical Techniques for Engineering, Science and Mathematics by Mumtaz Khan

IE-353–METROLOGY AND SQC

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK6

Semester : 5TH

COURSE LEARNING OUTCOMES (CLOS) FOR IE-353

Course Learning Outcomes (CLOs) for IE-353: **CLO No.**	**Course Learning Outcomes (CLOs)**	**Taxonomy Domain**	**PLOs Addressed by Course (PLO No.)**
1	Define metrology and Geometric dimensioning and tolerances (GDT), its importance and applications. (Knowledge)	C1	Engineering Knowledge (1
2	Discuss frequency distributions, and calculate measures of central tendency, dispersion, skewness	C2	Engineering Knowledge (1)
3	Classify sources of variations in processes for quality improvement and calculate process capability indices	C3	Problem Analysis (2)
4	Construct control charts for variables and attributes.	C5	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-353:

General principles of measurement, Geometric dimensioning and tolerances, Gauges and comparators, Interferometers and associated devices, Surface texture measurement, Study of frequency distributions and probability models in quality control, Sources of variation, Preparation and use of various control charts, Process Capability Indices, Construction of different sampling plans, Methods to quality improvement and analysis of quality costs, Computer applications in SQC

GRADING POLICY FOR IE-353:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-353:

1. Quality Control by D. H. Besterfield, Pearson Education

2. Introduction to Statistical Quality Control by Douglas C. Montgomery

3. Engineering Metrology by J. F. W. Galyer and C. R. Shotbolt, Cassell Publishers Ltd

4. Statistical Methods for quality improvement by Hitoshi Kume, Association for overseas technical scholarships (A. O. T. S.) Japan

List of Practical for IE-353

S. No.	List of Practical
1	To familiarize students with safety rules and measuring instruments in metrology laboratory
2	Fabrication of specimen work piece in advance machine shop. Collecting of data for its linear and angular dimensions
3	To study Vernier caliper (Analogue and Digital) and inspection of part manufactured in Lab. 2
4	To study Micrometer (Analogue and Digital) and inspection of part manufactured in Lab. 2

S. No.	List of Practical
5	To study Height gauges (Analogue and Digital) and inspection of part manufactured in Lab. 2
6	Introduction to surface roughness measurements devices and inspection of part manufactured in Lab. 2
7	Introduction to different kinds of measuring devices like dial indicators, gauge block etc. Introduction to MINITAB package
8	Calculation of various characteristics of data measure (measure of dispersion, measure of central tendency) using MINITAB
9	Variable data collected from experiment, create X-Bar and R-Chart (MINITAB) analyze charts , create revised control chart for variables
10	Capability analysis using MINITAB package of the data collected from experiment and interpret results
11	Capability analysis using MINITAB package of the data collected from experiment and interpret results
12	Control chart for attributes (p, n, np, etc) using MINITAB package
13	Control chart for attributes (p, n, np, etc) using MINITAB package
14	Brain storm session for finding the possible causes for out of specification work piece. Create cause and effect diagram (Fishbone) using MINITAB package

LAB CLOS FOR IE-353:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
5	Demonstrate different measuring instruments and make different types of control charts with the help of software	P4	Modern Tool Usage (5)

IE-352–MANUFACTURING SYSTEM

Contact Hours

Theory: 48

Lab : 48

Total : 96

Credit Hours

Theory: 03

Lab : 01

Total : 04

Knowledge Profile: WK5

Semester: 5th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-352:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know the basic concept of lean manufacturing, flexible manufacturing, cellular manufacturing and material handling system	C1	Engineering Knowledge (1)
2	To analyze the different manufacturing systems, material handling system and assembly lines	C4	Problem Analysis (2)
3	To design and improve the manufacturing system and its relative parameters	C5	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-352:

Introduction to Lean Manufacturing, Manufacturing automation fundamentals and strategies, High volume manufacturing systems, Flow lines, Assembly lines, Automated material handling and storage systems, Process planning, Group technology, Cellular manufacturing systems, Computer networks of manufacturing, Computer integrated manufacturing systems, Flexible manufacturing systems, Modeling of manufacturing systems.

LIST OF PRACTICALS FOR IE-352

S.No	Content
1	Introduction to manufacturing system
2	Manufacturing Automation and strategies
3	Production volumes, low, high and medium
4	Material Handling system
5	Storage system
6	Storage system analysis
7	Manual production lines
8	Manual production line analysis
9	Mid Term
10	Assembly Lines
11	Flow lines
12	Group technology
13	Group technology analysis
14	Cellular manufacturing
15	Assembly line balancing
16	Flexible manufacturing system
17	Lean manufacturing

RECOMMENDED BOOKS FOR IE-352:

1. Automation, Production Systems and Computer Integrated Manufacturing by M. P. Groover, Prentice Hall

2. Modelling and Analysis of Manufacturing Systems by Askin and Standridge, John Wiley and Sons

GRADING POLICY FOR IE-352:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

LIST OF PRACTICAL FOR IE-352

S. No	List of Practical
1	Introduction to CNC Programming
2	Linear Interpolation at CNC Mill
3	Circular Interpolation at CNC Mill
4	Linear Interpolation at CNC Lathe
5	Circular Interpolation at CNC Lathe
6	Sub Programming at CNC Mill
7	Sub Programming at CNC Lathe
8	Simple drilling Cycle
9	Spot drilling Cycle
10	Deep drilling Cycle
11	Tapping Cycle
12	Reaming Cycle
13	Boring Cycle
14	Thread Cycle

S. No	List of Practical
15	CNC Operation Control
16	Work Piece Zero Setting and Tool Offsetting

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-352:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Practice CNC programming and CNC operations	P3	Modern Tool Usage (5)

IE-356–OPERATION RESEARCH

Contact Hours

Theory: 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK4

Semester : 5th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-356:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Formulate real life problems into optimization problems	C4	Problem Analysis (2)
2	Apply different optimization methods and techniques especially on linear programming problems, and queuing problems	C3	Design and Development of Solution (3)
3	To interpret solution obtained from different optimization methods and softwares	C6	Investigation (4)

HEC COURSE CONTENT FOR IE-356:

Application of Linear Algebra to Industrial Problems, Introduction to Linear Programming, Graphical method of solving L.P. problems, Simplex method, Duality and Sensitivity, Solving large scale problems using computer, Transportation and Assignment Problems, Network problems, shortest path, minimum spanning tree, maximum flow problems, Queuing theory

GRADING POLICY FOR IE-356:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-356:

1. Operations Research by H. A. Taha, Prentice Hall
2. Operation Management-Strategy and analysis by Krajewsky and Ritzman
3. Operations Research by S. Kalavathy, Vikas Publishing House.
4. Operations Research: Applications and Algorithms by Wayne L. Winston

LIST OF PRACTICAL FOR IE-356

S. No	List of Practical
1	Introduction to different optimization software's 1. TORA 2. LINGO 3. AMPL 4. EXCEL
2	1. Maximization problem (Reddy Mix on TORA) 2. Minimization problem (Diet problem on TORA)
3	1. Reddy Mix and Diet problem on LINGO and AMPL 2. LP application (Urban Planning) on TORA

S. No	List of Practical
4	Investment and production planning model on TORA and LINGO
5	Blending and oil refining problem on TORA and LINGO
6	LP applications with EXCEL template
7	LP applications with EXCEL template
8	Presentations on TORA, LINGO, AMPL, EXCEL Solver, EXCEL Templates
9	Presentations on TORA, LINGO, AMPL, EXCEL Solver, EXCEL Templates/Mini project selection
10	Transportation problem on TORA and LINGO
11	Minimal Spanning Tree algorithm on TORA (2 Problems)
12	1. Maximum flow problem on TORA 2. Shortest route algorithm on TORA
13	1. Simple Queing models on TORA and EXCEL 2. Generalized poisson queing models on TORA and EXCEL
 14	Single server and multi server queing models on TORA and EXCEL

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-356:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To Practice different optimization softwares	P3	Modern Tool Usage (5)

IE-355–WORK STUDY AND METHOD ENGINEERING

Contact Hours

Theory: 32

Lab : 48

Total : 80

Credit Hours

Theory : 02

Lab : 01

Total : 03

Knowledge Profile: WK5

Semester: 5th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-355:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Acquire knowledge of work study, time study its measurement, applications, and limitations.	C1	Engineering Knowledge (1)
2	Apply time and motion study principles for calculating various dimensions of time and motion study on existing methods and improved methods.	C3	Investigation (4)
3	Evaluation of improvement in proposed method by optimizing work techniques in human machine systems utilizing pre-determined motion time studies (PMTS), and standard times principles.	C6	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-355:

Introduction to work analysis and design, Methods engineering: study of the basic work measurement techniques, applications and limitations of the stopwatch time study, learning curve, Development and use of process flow charts, pre-determined motion time studies (PMTS), micro motion analysis, Human factors underlying the design of specific human-machine systems, Techniques of work optimization, energy expenditure and bodily functions.

GRADING POLICY FOR IE-355:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-355:

1. Motion and Time Study by Benjamin W. Niebel, McGraw-Hill

2. Time and Motion study by I. L. O.

3. Motion and time study design and measurement of work by Ralph M.Barnes

List of Practical for IE-355

S. No	List of Practical's
1	Introduce and narrate the applications of Work Study and Methods Engineering
2	Conduct a study with the help 5 step process solving technique to solve a problem by choosing the best alterative with reasons.
3	Design the flow chart of the processes of an organization.
4	Compose Gantt chart for the process of an organization or task of a project.
5	Execute the improvement with use of any or all the methods of work design.
6	Design the process chart for the existing and improved process.

S. No	List of Practical's
7	Design a gang process chart for a process manually and reproduce it using MS Visio to observe the time difference.
8	Design the activity chart of a process and design the improved process activity chart.
9	Design the man and machine chart of a process calculate the utilization and improve the utilization of the man and machine.
10	Practice a process and construct left and right hand chart for an activity.
11	Conduct the Micro motion study with use of available equipment.
12	Design a simo chart and an activity sheet for left and right hand activity.
13	Improve the efficiency of an organization by use of motion economy principles.
14	Conduct a study on a process to calculate standard time considering the allowances.
15	Conduct a time and motion study to determine the sufficient sample size for that study including rating factor.
16	Conduct a study to prove learning curve behavior.

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-355:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Show dexterity in understanding and making basics charts of time and motion	P4	Investigation (4)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	study along with conduction of time and motion studies.		

SCHEME OF STUDIES FOR 6TH SEMESTER

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
6	1	IE-360	Industrial System Simulation	(2-1-3)	Computing	Intro. To Computing, and Probability and Statistics	2
	2	IE-361	Human Factor Engineering	(2-1-3)	Major Based Core (Depth)	Work Study and Methods Engg.	—
	3	IE-232	Management of Engineering Projects	(3-0-3)	Management Sciences	Engg. Management Engg. Economics	—
	4	IE-366	Production Planning and Control	(2-1-3)	Major Based Core (Breadth)	Operations of Manufacturing System	3
	5	IE-367	Industrial Maintenance and Safety	(3-0-3)	Major Based Core (Breadth)	Human Factors Engg. and Operations of Manufacturing Systems	
Total Credit Hours				(12-3-15)			

IE-360–INDUSTRIAL SYSTEM SIMULATION

Contact Hours

Theory : 32

Lab : 48

Total : 80

Knowledge: WK2

Credit Hours

Theory : 02

Lab : 01

Total : 03

Semester : 6th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-360:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know the fundamental concepts and techniques of discrete-event modelling & simulation in the context of manufacturing systems	C1	Engineering Knowledge (1)
2	To apply the mathematical and statistical techniques to transform the real world system into a simulation model	C3	Modern Tool Usage (5)
3	To verify, validate and interpret the results of simulation model	C6	Investigation (4)

HEC COURSE CONTENT FOR IE-360:

Introduction to simulation concepts, Random number generation, Simulation model building, Simulation languages, Model validation and output, Development of various simulation models of practical nature using ARENA or any other simulation software.

GRADING POLICY FOR IE-360:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-360:

1. Simulation with ARENA
2. Discrete System Simulation by Jerry Banks, Prentice Hall.

List of Practical for IE-360

S. No	List of Practicals
1	Introduction to ARENA, Explanation of basic process, advance process and advance transfer modules.
2	Development of Single Server Model in ARENA.
3	Analysis of Simulation report. Setting up run conditions. Effect of process parameters on simulation output.
4	Adding Animation and Dynamic plots. WIP versus Simulation clock, WIP verses cycle time
5	Electronic assembly and test system. (case Study)
6	Animation of electronic assembly and test system
7	Input Analyzer
8	Handling multiple resources with failures

S. No	List of Practicals
9	The Call Centre simulation
10	The Call Centre simulation
11	Call center simulation results
12	Sequences and Travelers (case study of manufacturing cell)
13	Part specific Processing Times and Single Part Source: case study of manufacturing cell
14	Modeling scheduled entity movements.
15	Mini Project Presentations
16	Mini Project Presentations

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-360:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To practice the simulation models on different simulation software's	P3	Modern Tool Usage (5)

IE-361 –HUMAN FACTORS ENGINEERING

Contact Hours

Theory : 32

Lab : 48

Total : 80

Credit Hours

Theory : 02

Lab : 01

Total : 03

Knowledge Profile: WK7

Semester : 6th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-361:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know basics of ergonomics such as illustration of information by text and graphics, Climatic Factors, Noise, Vibration and its Effects of on various organs and anthropometry.	C1	The Engineers and Society (6)
2	Illustrate and apply ergonomic Principles at workplace and equipment design along with controls in advance technology.(Application)	C3	Design and development of solution (3),

HEC COURSE CONTENT FOR IE-361:

Introduction to Human Factors Engineering, Human Characteristics relevant to ergonomics. Information on Human Role in artificial Intelligence, information by text, graphics and symbols. Anthropometry, Anthropology, Principles of workplace design, Equipment and work space, Failure of design, Climatic Factors, Noise and Vibration, Effects of noise on various organs and its prevention, visibility (Illumination, contrast, quality, colour etc.) and its effects, Basic concepts of Human Error detection and reduction. The role of controls in advanced technology, Control devices.

TEXT BOOKS FOR IE-361:

1. An Introduction to Human Factors Engineering by Wickens, Gordon, Liu.
2. Hand-Book of Industrial Engineering: Technology and Operations, by Salvendy G., McGraw-Hill
3. Human Factors Engineering & Design by Sanders & Mc Cormick

GRADING POLICY FOR IE-361:

Quizzes	:	10 %
Lab reports	:	15 %
Mid Term	:	25 %
Final	:	50 %

LIST OF PRACTICAL FOR IE-361

S. No	List of Practical
1	Introduction to human factors engineering.
2	Practice to monitor oxygen level in different conditions using oxygen analyzer.
3	Practice to use heartbeat sensor and study the variation of parameter in result with use of manual cycle and heartbeat.

S. No	List of Practical
4	Practice to monitor the parameters of thermometer and thermocouple.
5	Practice to monitor various parameters using heat stress meter (WBGT).
6	Practice to monitor the wind chill, ambient temperature with the use of anemometer.
7	Practice to operate sound meter to measure sound intensity at various levels.
8	Practice to use the available software to check human functionality.
9	Practice to use the available software to check human functionality.
10	Operate ergo medic cycle and measure various human parameters.
11	Practice to operate light meter to monitor the intensity of light at various conditions.
12	Practice to use Psychometer and IR thermometer to measure its various parameters.
13	Practice to use force gauge and measure compression and tension and understand the underling principle.
14	Practice to use anthropometric scale to measure human dimensions.
15	Practice to operate biometric sensor for motion detection.
16	Practice to use of treadmill for exertion calculation

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-361:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3		P3	Modern tool usage (5)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	Practice different ergonomics equipment's with necessary knowledge.		

IE-232–MANAGEMENT OF ENGINEERING PROJECTS

Contact Hours

Theory : 48

Lab : 0

Total : 48

Credit Hours

Theory : 03

Lab : 0

Total : 03

Knowledge Profile: WK4

Semester: 6th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-232:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To be able to define the basic terms and functions of project management, project manager and team role and formation. Select the criteria for project selection (Knowledge)	C1	Project Management (11)
2	To recognize different stages involved in project planning. Demonstrate the knowledge and confidence to manage a project from beginning to end (Comprehension)	C2	Project Management (11)
3	To apply the concepts such as planning, scheduling, monitoring and controlling through PERT and CPM analysis and to address	C3	Project Management (11)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	specific management needs at the individual, team, division and/or organizational level (Application)		
4	To recognize risk and select risk management techniques such as project crashing and project network revisions to achieve goals (Analysis)	C4	Project Management (11)

HEC COURSE CONTENT FOR IE-232:

Project management concepts, project proposals and feasibility, initiating, Planning, execution, monitoring and control, closing and Exit strategy, knowledge areas as per PMBOK/PRINCE-2, introduction to any Project Management's Software.

GRADING POLICY FOR IE-232:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-232:

1. Gido, J. and Clements, J.P., Successful Project Management 2e, Thomson South-Western, 2003, ISBN 0-324-07168-X

2. Meredith, J.R. and Mantel, S.J., Project Management: A Managerial Approach, 4th Edition, John Wiley, 2000 3rd Edition.

3. Clifford F. Gray, Erik W. Larson Project Management: The Managerial Process 2nd Edition McGraw-Hill Irwin

4. Jay Heizer, Barry Render, Operations Management, Prentice Hall

IE-366–PRODUCTION PLANNING AND CONTROL

Contact Hours

Theory : 32

Lab : 48

Total : 80

Credit Hours

Theory : 02

Lab : 01

Total : 03

Knowledge Profile: WK4

Semester : 6th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-366:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To be able to know about production, forecasting, inventory, scheduling, aggregate and capacity planning. (Knowledge)	C1	Engineering Knowledge(1),
2	Apply the quantitative models of productivity, forecasting, production planning, scheduling, inventory control and capacity planning (Application)	C3	Problem Analysis (2),
3	Evaluate appropriate production model for a manufacturing environment. (Evaluation)	C6	Design/Development of Solutions (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR IE-366:

Study of different forecasting methods and their applications to various industrial and management problems, Analysis and design of production and scheduling control systems, machine sequencing, Flow shop, Job shop, Open shop, Algorithms for production planning and re-planning, Stochastic inventory models, Aggregate planning, Capacity requirements planning, Introduction to mixed production models

GRADING POLICY FOR IE-366:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

BOOKS FOR IE-366:

1. Operations Management By Heizer and Render
2. Factory Physics By Hopp and Spearman

LIST OF PRACTICAL FOR IE-366

S. No	List of Practicals
1	Case study/Research paper related to production planning and control
2	Case study/Research paper related to forecasting
3	MS Excel use with respect to forecasting
4	MS Excel use with respect to forecasting

S. No	List of Practicals
5	Case study/Resarch paper related to scheduling
6	Scheduling problems on Excel
7	Tutorial
8	Case study/Research paper on inventory management
9	Inventory management problem on MS Excel
10	Inventory management problem on MS Excel
11	Case study/Research paper on capacity requirment planning
12	Capacity requirment planning on MS Excel
13	Tutorial

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-366:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Develop computer templates for various production models	P7	Modern Tool Usage (5)
5	To summarize best practices currently employed in industry through case studies	C2	Individual and Team Work (9)

IE-367–INDUSTRIAL MAINTENANCE AND SAFETY

Contact Hours

Theory: 48

Lab : 0

Total : 48

Credit Hours

Theory : 03

Lab : 0

Total : 03

Knowledge Profile: WK3

Semester: 6th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-367:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To organize different types of safety and maintenance along with water and environmental issues for better decision making on economical, legal and humanitarian grounds.	C5	The Engineers and Society (6)
2	To assess air emissions, waste, safety, and maintenance management systems	C6	The Engineers and Society (6)

HEC COURSE CONTENT FOR IE-367:

Importance of plant maintenance, factors influencing the maintenance, Considerations in designing plant maintenance, Economic aspects of maintenance, care and maintenance of common industrial equipment (like bearings, piping, filters, pumps, compressors, and lubricating systems),

maintenance linkage to safety, Different systems/types of maintenance, Laws of Accident Proneness, Accidents preventions. Legal, humanitarian & economic reasons to Prevent Accidents, Safety Measures, Analysis & Procedures, Safety equipment, OHSAS 18000.

GRADING POLICY FOR IE-367:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-367:

1. Maintenance Manager's Standard Manual by Thomas A. Wester-Kamp, Prentice-Hall
2. A Guide to Effective Industrial Safety by Jack W. Boley, Gulf Publishing Company.

RECOMMENDED BOOKS FOR IE-367:

1. Engineering Maintenance by .S. Dhillon, Ph.D. CRC press.
2. Maintenance engineering handbook by R. Keith Mobley Editor in Chief, Lindley R. Higgins and Darrin J. Wikoff , McGraw Hills Handbooks.

SCHEME OF STUDIES OF 7TH SEMESTER

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
7	1	IE-472	Design of Experiment	(3-0-3)	Inter-Disciplinary	Probability and Statistics	
	2	IE-358	Industrial Facilities Design	(2-1-3)	Major Based Core (Depth)	Work Study and Methods Engg. Production Planning and Control	—
	3	IE-412	Operations of Manufacturing Systems	(3-1-4)	Major Based Core (Breadth)	Engg. Management	4
	4	IE-498	Project Phase-I	(0-3-3)	Senior Design Project	None	
	5	IE-4XX	Covered in next section				
Total Credit Hours				(11-6-17) One elective are offered			

IE-410– DESIGN OF EXPERIMENT

Contact Hours

Theory : 48

Lab : 00

Total : 48

Credit Hours

Theory : 03

Lab : 0

Total : 03

Knowledge Profile: WK4

Semester : 7th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-410:

CLO No.	Course Learning Outcome (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	Know the importance of basic principles in engineering experimental design in conducting experiments and strategies in planning and conducting experiments	C1	Engineering Knowledge (1)
2	**Develop** an appropriate hypothesis and drawing appropriate conclusion through statistical analysis	C3	Design and Development of Solution (3)
3	Formulate experimental data through analysis of variance (ANOVA)	C4	Design and Development of Solution (3)
5	Choose an appropriate experiment to evaluate a new product design or process improvement through experimentation strategy, data analysis, and interpretation of experimental results using factorial design approach	C6	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-410:

Understanding quality, commitment and leadership, design for quality, planning for quality, quality system requirements, quality measuring tools and the improvement cycle, Quality assurance, ISO 9001, Six sigma, Kaizen, Balanced score card.

GRADING POLICY FOR IE-410:

Sessional	:	25 %
Mid Term	:	25 %
Final	:	50 %

TEXT BOOKS FOR IE-410:

Computer Automation in Manufacturing By Thomas O. Boucher

IE-358– INDUSTRIAL FACILITIES DESIGN

Contact Hours

Theory : 32

Lab : 48

Total : 80

Credit Hours

Theory : 02

Lab : 01

Total : 03

Knowledge Profile: WK4

Semester : 7th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-358:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To acquire the **knowledge** and understanding of the different stages of Location Analysis, Facilities Planning, Layouts, and Material Handling Systems.	C1	Engineering Knowledge (1)
2	To solve facility location and Layout problems by **applying** analytical facilities location and layout methods **(Application)**.	C3	Design and Development of Solution (3)
3	To **design** and **analyze** material handling systems through material handling principles used in manufacturing **(Evaluation).**	C6	Problem Analysis (2)

HEC COURSE CONTENT FOR IE-358:

Location and Site selection, Facility design stages, processes, material handling equipment and analysis, Area allocation and space requirements, Flow analysis, fabrication of individual parts, total plant flow, Plant layout, Utilities Layout, Computerized facility layout and location, Strategies for storages.

GRADING POLICY FOR IE-358:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-358:

1. Manufacturing Facilities: Location, Planning & Design by D. Sule, B.W.S.- Kent Publishing.

2. Facilities Planning by Tomkins & White, John Wiley

LIST OF PRACTICAL FOR IE-358

S. No	List of Practical
1	Optimized facility location using break even analysis in excel
2	Facility location using factor rating method in excel
3	Facility location using centre of gravity /centroid method in excel
4	Heuristic method involving facilities with unlimited capacities with help of excel
5	Heuristic method involving facilities with unlimited capacities with expected life with help of excel
6	Unassignable locations heuristic using excel
7	Location of multi facilities of different types using half sum method
8	Single facility minimax problem using excel

S. No	List of Practical
9	Process and product requirements
10	Schedule and number of equipment
11	Machine Fraction
12	Adjacency Graph method
13	CRAFT (Pair wise exchange method)
14	PLANET
15	Line Balancing Techniques
16	OR in materials handling equipment selection

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-358:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To demonstrate the skills in solving different types of location and layout problems	P4	Modern Tool Usage (5)

IE-412– OPERATIONS OF MANUFACTURING SYSTEMS

Contact Hours

Theory : 48

Lab : 48

Total : 96

Knowledge Profile: WK4

Credit Hours

Theory : 03

Lab : 01

Total : 04

Semester : 7th

COURSE LEARNING OUTCOMES (CLOS) FOR IE-412:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know concepts and applications of forecasting, material requirement planning (MRP), enterprise resource planning (ERP), just in time, push pull and hybrid systems. **(Knowledge)**	C1	Engineering Knowledge (1)
2	Apply inventory models and techniques to create and recommend appropriate stocking solutions in various organizations. **(Application)**	C3	Design and Development of Solution (3)
3	To assess and justify key drivers of supply chain performance and their inter-relationships with strategy and other	C6	Investigation (4),

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	functions of the company such as marketing, manufacturing, and accounting. **(Evaluation)**		

HEC COURSE CONTENT FOR IE-412:

Inventory Control, Material requirement planning, Manufacturing resource planning, Enterprise resource planning, Just in time, Total quality manufacturing, Factory dynamics, Push, Pull and hybrid systems, Inventory control in supply chain.

GRADING POLICY FOR IE-412:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-412:

1. Factory Physics by Hopp & Spearman, McGraw-Hill
2. Production and Operations Analysis by Steven Nahmias, McGraw-Hill

List of Practical for IE-412

S. No	List of Practical
1	EOQ Model Tutorials (solving different numerical in the class)
2	EOQ Model based Research Papers and case studies review and presentation by each group of the students.
3	MRP Tutorials (solving different numerical in the class)
4	Review and presentation of the research papers and case studies related to MRP by each group in the class.

S. No	List of Practical
5	Just In Time Tutorials (solving different numerical in the class)
6	JIT based Research Papers and case studies review and presentation by each group.
7	Internal benchmarking Tutorials (solving different numerical in the class)
8	Review and presentation of the research papers and case studies related to internal bench marking by each group in the class.
9	Tutorials (solving different numerical in the class)
10	CONWIP based Research Papers and case studies review and presentation by each group of the students.
11	Tutorials (solving different numerical in the class)
12	Supply chain related Research Papers and case studies review and presentation by each group of the students.
13	Review of Research papers related to manufacturing resource planning by the students.
14	Presentation based on case studies related to MRP II by the group of students
15	Review of Research papers related to Enterprise Resource Planning (ERP) by the students.
16	Presentation based on case studies related to ERP by the group of students.

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-412:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To Practice research papers and case studies related to different topics of OMS	P3	Individual Team Work (9)

SCHEME OF STUDIES FOR 8TH SEMESTER AND ELECTIVES

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
8	1-4	IE-499	Project Phase-II	(0-3-3)	Senior Design Project	None	
Elective Courses							
Electives	1	IE-474	CAD/CAM	(3-1-4)	Computing	None	6
	2	IE-414	Human Resource Management	(3-0-3)	Major Based Core (Depth)	None	
	3	IE-416	Computer Integrated Manufacturing	(3-1-4)	Major Based Core (Depth)	CAD/CAM, Industrial Facilities Design	5
	4	IE-480	Metal Forming and Cutting Analysis	(3-1-4)	Major Based Core (Depth)	Manufacturing Processes	
	5	IE-430	Tool and Die Design	(3-1-4)	Major Based Core (Depth)	Mechanics of Material	

Semester No.	Courses/Group of Courses			Credit Hours	Knowledge Area	Pre-Requite Courses (If Any)	WK
	6	IE-410	Automation and Control	(3-1-4)	Major Based Core (Depth)	Manufacturing Systems	
	7	IE-362	Total Quality Management	(3-1-4)	Major Based Core (Depth)	None	
	8	IE-401	Management Information System	(3-1-4)	Major Based Core (Depth)	Intro. To Computing	
	9	IE-425	Reliability Analysis	(3-0-3)	Major Based Core (Depth)	Probability and Statistics	
	10	IE-450	Special Topics	(3-0-3)	Major Based Core (Depth)	None	
	11	IE-422	Logistics Management	(3-0-3)	Major Based Core (Depth)	Production Planning and Control	

IE-474– CAD/CAM

Contact Hours

Theory : 48

Lab : 48

Total : 96

Knowledge Profile: WK6

Credit Hours

Theory : 03

Lab : 01

Total : 04

Semester : Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-474:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To **know** the fundamental theory and concepts of the CAD/CAM and CNC machines. **(Knowledge)**	C1	Engineering Knowledge (1)
2	Develop the concepts of computer graphics and underlying theory of modeling and the usage of models in different engineering application. **(Application)**	C3	Modern Tool Usage (5)
3	**Compare** and **distinguish** between the operation and programming of a CNC machine tool using manual programming	C4	Modern Tool Usage (5)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
	and using CAD/CAM systems. **(Analysis)**		

HEC COURSE CONTENT FOR IE-474:

Computer methods in design, Computer geometric modelling, Transformations, Projection, Process planning, Types of tool path generation methods for sculptured surfaces, CAD/CAM databases, Introduction to automated machine tools and cutting tools, Numerical control, motion control, CNC machine tools programming, Robotics, Configuration and motions.

GRADING POLICY FOR IE-474:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-474:

1. Mastering CAD/CAM by Ibrahim Zaid, McGrall-Hill
2. Principles of CAD/CAM/CAE Systems by Knunwoo Lee, Addison Wesley

LIST OF PRACTICAL FOR IE-474

S. No	List of Practical
1	Introduction to Geometric Construction (in Pro E)
2	Extrusion and Remove Material Commands
3	Chamfer, Round (Fillet) and Hole Features
4	Revolve Command

S. No	List of Practical
5	Sweep Command
6	Blending
7	Draft and Helical Sweep
8	Pattern
9	Assembly Modeling in Pro E Assembly Module
10	Mechanism in Pro E Assembly Module
11	Drawing Module of Pro E
12	Volume Milling in Pro E Manufacturing Module
13	Profile Milling in Pro E Manufacturing Module
14	Engraving and Hole Making in Pro E Manufacturing Module
15	Pocket Milling in Pro E Manufacturing Module
16	Turning: Profile and Threading in Pro E Manufacturing Module

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-474:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Construct geometric computer models	P7	Modern Tool Usage (5)

IE- 414– HUMAN RESOURCE MANAGEMENT

Contact Hours

Theory : 48

Lab : 00

Total : 48

Knowledge Profile: WK5

Credit Hours

Theory : 03

Lab : 00

Total : 03

Semester : Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-414:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe basic theories and practice of HRM and its role in industry	C2	Engineering Knowledge (1)
2	Examine basic concepts of HRM including Job analysis and design, hiring and firing, salary and wages, job appraisal, human factor, facilities, rewards and bonuses	C3	Investigation (1)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	Synthesize basic concepts of Human Resource Management for an industrial application **(Application)**.	C5	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-414:

Theory and practice of HRM, Work groups and their implications for motivation and job satisfaction, Theories of motivation, Manpower planning, Recruitment and selection process, Training and Development, Appraisal Methods. Principles of wage and salary administration, Job analysis & Description, Job Design, Industrial Relations, Causes of Industrial disputes and their resolutions.

GRADING POLICY FOR IE-414:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-414:

1. Managing Human Resources by Wayne Cascio.
2. Human Resource Management by De Cenzo Robbins
3. Elements of Personnel Management by Pratt, K. J. and Bennett, S. G. Gee & Co.

IE-416– COMPUTER INTEGRATED MANUFACTURING (CIM)

Contact Hours	**Credit Hours**
Theory : 48	**Theory : 03**
Lab : 48	**Lab : 01**
Total : 96	**Total : 04**
Knowledge Profile: WK5	**Semester: Elective**

COURSE LEARNING OUTCOMES (CLOS) FOR IE-416:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To **know** about CIM, its importance, applications, flow diagrams, decision support systems, computer networks and IDEF Models. **(Knowledge)**	C1	Engineering Knowledge (1)
2	To **assess** and **justify** CIM usage and its investment and integration impact **(Evaluation)**.	C6	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To **apply** decision support system for CIM investment and implementation. **(Application)**	C3	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-416:

Introduction to Computer Integrated Manufacturing, components of CIM system, CIM modelling, data flow diagrams and IDEF models, Integration of interconnected networks, computer network protocols, integrated approach to CIM justification and optimization, assessing the impact of investment in CIM, a decision support system for CIM investment, guidelines for implementing CIM, Application of CIM System in small & medium enterprises (SMEs).

GRADING POLICY FOR IE-416:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-416:

1. CIM justification and optimization by Lin and Nagalingan, Taylor and Francis Taylor and Francis. 27
2. Computer Integrated Design and Manufacturing by Nanua Singh, John Wiley & Sons.

LIST OF PRACTICAL FOR IE-416

S. No	List of Practicals
1	Introduction to CIM System
2	Introduction to Robot and its Functions
3	Different Types of Robot Jog Operations
4	COSIMIR Software Interface
5	Customizing Robot Tool
6	Pick and Drop Operation of Robot
7	Sensor Input and Output
8	Linear/Circular Interpolation of Robot
9	Coordinate Calculation with Equations
10	Defining Pallet Operation in Robot
11	Input Output Commands
12	Different Arcs Commands
13	Configuring and operating two different Robot Controllers

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-416:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To operate a robot for different types of operation.	P3	Modern Tool Usage (5)

IE-480 – METAL FORMING AND CUTTING ANALYSIS

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK4

Semester: Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-480:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To know about metal forming and machining processes and its classification.	C1	Engineering Knowledge (1)
2	To analyze the forming processes and the effect of tool material and tool geometry. To determine cutting mechanisms, materials and material removal operations.	C4	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To explain the machine performance and its optimization. Able to design of jigs and fixtures.	C5	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-480:

Objectives of Metal Forming Processes, Classification of processes, Sheet metal formability, Analysis of bending, Drawing; Rolling, Extrusion and Forging Processes, Evaluation of machining performance and its optimization, Objectives of metal cutting processes, Cutting mechanisms, Material removal operations, Cutting tool materials and geometry, Effects of different cutting parameters on tool life and cutting forces, Tool design, Jigs and fixtures design.

GRADING POLICY FOR IE-480:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-480:

1. Manufacturing Engineering & Technology by Kalpakjian & Schmid, Prentice Hall
2. Metal forming: Mechanics and Metallurgy, W. F. Hosford, R. M. Caddell, Cambridge University Press.
3. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGraw- Hill Inc.

LIST OF PRACTICAL FOR IE-480

S. No	List of Practicals
1	To study various safety rules for machining shop
2	Transformation of given specimen into the shape through machine-1
3	Transformation of given specimen into the shape through machine-2
4	Transformation of given specimen into the shape through machine-3
5	Transformation of given specimen into the shape through machine-4
6	To analyze wear patterns on Lathe
7	To analyze wear patterns on Milling
8	To analyze wear patterns on Drilling
9	To perform different types of sheet metal operations-1
10	To perform different types of sheet metal operations-2
11	To perform different types of sheet metal operations-3
12	To perform different types of sheet metal operations-4
13	To perform different types of sheet metal operations-4

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-480:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To operate different machines	P3	Modern Tool Usage (5)

IE-430 – TOOL AND DIE DESIGN

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK5

Semester: Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-430:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe tool and die, their design parameters, and different presses	C2	Engineering Knowledge (1)
2	Discuss different types of tools for inspection, gauging, presses, die casting etc;	C3	Problem Analysis (2)
3	Design different types of tools and die for industrial applications	C5	Design and Development of Solution (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR IE-430:

Objectives of Metal Forming Processes, Classification of processes, Sheet metal formability, Analysis of bending, Drawing; Rolling, Extrusion and Forging Processes, Evaluation of machining performance and its optimization, Objectives of metal cutting processes, Cutting mechanisms, Material removal operations, Cutting tool materials and geometry, Effects of different cutting parameters on tool life and cutting forces, Tool design, Jigs and fixtures design.

GRADING POLICY FOR IE-430:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-430:

1. Manufacturing Engineering & Technology by Kalpakjian & Schmid, Prentice Hall
2. Metal forming: Mechanics and Metallurgy, W. F. Hosford, R. M. Caddell, Cambridge University Press.
3. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGraw- Hill Inc.

LIST OF PRACTICAL FOR IE-430

S. No	List of Practicals
1	To study various safety rules for machining shop
2	To study/survey different metals for making/manufacturing of tools

S. No	List of Practicals
3	To study different clamping, locating and locking components for jigs and fixtures
4	To study different clamping, locating and locking components for jigs and fixtures-2
5	To study differnet clamping, locating and locking components for jigs and fixtures-3
6	To study the working of power/hydraulic press
7	To design a blanking die for a typical part
8	To the functions of compound dies
9	To study progressive dies
10	To the functions of different components of an injection mold
11	To the functions of different components of an injection mold-2
12	Design of plastic injection molds using CAD software
13	Design of plastic injection molds using CAD software

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-430:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To practice different tools	P3	Modern Tool Usage (5)
5	To design different tool and die	P7	Modern Tool Usage (5)

IE-410–AUTOMATION AND CONTROL

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK6

Semester: Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-410:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To **know** about process control fundamentals, sensors, architecture of PLC, DCS , SCADA, Relays and Robots **(knowledge)**	C1	Engineering Knowledge (1)
2	To **differentiate** and use different PLCs, Sensors, and robots **(Application).**	C3	Modern Tool Usage (5)
3	To **assess and justify** various control devices, microprocessors, microcontrollers and robots **(Evaluation)**	C6	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-410:

Process control fundamentals, Relay logic and various control devices, Architecture of programmable logic control units, Introduction to distributed control system (DCS) and SCADA Sensors for industrial processes, D/A and A/D converters, Industrial processes interfacing with micro-processors, practical applications, Introduction to Robotics, Robot anatomy, Robot configuration, accuracy & Repeatability, Robot specifications, end effectors, Kinematics and Dynamics, Characteristics of Robot applications, Robot Cell Design, types of Robot Applications.

GRADING POLICY FOR IE-410:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-410:

Computer Automation in Manufacturing By Thomas O. Boucher

LIST OF PRACTICAL FOR IE-410

Week	Topics Description
1	Introduction to control system and automation, automation equipments and automation labs rules and regulations.
2	On-hand practical on interfacing different electrical and electronic components
3	PID Controller
4	Servomechanism
5	Relay Logic
6	Industrial Temperature Sensor
7	Industrial Inductive Sensors
8	Interfacing A/D and D/A

Week	Topics Description
9	Use of Microcontrollers
10	Project Presentations
11	Projrect Presentations
12	PLC Programing
13	PLC Interfacing
14	SCADA and DCS Systems
15	Industrial Robots Interfacing and Programming
16	Katana Robots

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-410:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To operate different types of sensors	P3	Modern Tool Usage (5)
5	To show dexterity in using different automation tools	P4	Individual and Team Work (9)

IE-362–TOTAL QUALITY MANAGEMENT

Contact Hours

Theory : 48

Lab : 48

Total : 96

Credit Hours

Theory : 03

Lab : 01

Total : 04

Knowledge Profile: WK5

Semester: Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-362:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe quality management quality assurance, ISO 9001, Six Sigma and other TQM terms	C2	Engineering Knowledge (1)
2	To examine different TQM topics mentioned in courses contents	C3	Problem Analysis (2)
3	To propose solutions on the basis of TQM principles and methods	C5	Design and Development of Solution (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)

HEC COURSE CONTENT FOR IE-362:

Process control fundamentals, Relay logic and various control devices, Architecture of programmable logic control units, Introduction to distributed control system (DCS) and SCADA Sensors for industrial processes, D/A and A/D converters, Industrial processes interfacing with micro-processors, practical applications, Introduction to Robotics, Robot anatomy, Robot configuration, accuracy & Repeatability, Robot specifications, end effectors, Kinematics and Dynamics, Characteristics of Robot applications, Robot Cell Design, types of Robot Applications.

GRADING POLICY FOR IE-362:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-362:

Computer Automation in Manufacturing By Thomas O. Boucher

LIST OF PRACTICAL FOR IE-362

Week	Topics Description
1	Introduction to Minitab/Excel and SPSS
2	Minitab-1
3	Minitab-2
4	Minitab-3

Week	Topics Description
5	Minitab-4
6	Excel-1
7	Excel-2
8	Excel-3
9	Excel-4
10	SPSS-1
11	SPSS-2
12	SPSS-3
13	SPSs-4

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-362:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	To practice problems on Minitab/Excel/SPSS	P3	Modern Tool Usage (5)

IE-401– MANAGEMENT INFORMATION SYSTEM

Contact Hours	**Credit Hours**
Theory : 48	**Theory : 03**
Lab : 48	**Lab : 01**
Total : 96	**Total : 04**
Knowledge Profile: WK2	**Semester: Elective**

COURSE LEARNING OUTCOMES (CLOS) FOR IE-401:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To **know** about different types of industrial information, retrieval systems, data processing technologies, networking, data backup and security and databases. **(knowledge)**	C1	Engineering Knowledge (1)
2	To **apply** various information processing methods and develop different industrial databases (**Application)**.	C3	Design and Development of Solution (3)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To assess secure networks and databases. **(Evaluation)**	C6	Investigation (4)

HEC COURSE CONTENT FOR IE-401:

Analysis, design and implementation of Industrial information and retrieval systems with special emphasis given to manufacturing systems, gathering, recording, analyzing and presenting the data requirements of an organization, Data processing technologies, Databases and their applications, Data protection, Networking, Backup and security.

GRADING POLICY FOR IE-401:

Sessional : 25 %

Mid Term : 25 %

Final : 50 %

TEXT BOOKS FOR IE-401:

Management Information Systems by K. C. Laudon & J. P. Laudon, Prentice Hall

List of Practical for IE-401

S. No	List of Practical
1	Introduction to database and different database software's available in market
2	Introduction to Microsoft Access, How MS Access is different and useful in creating database
3	Table generation in MS Access and Data importing from excel sheets

S. No	List of Practical
4	Importance of queries in database and Query generation
5	How forms could be effective in developing databases and forms creation
6	Reports generation in MS Access
7	Full fledge database generation
8	Project discussion
9	Case study 1: IPL teams strike gold with information technology
10	Case study 2: UPS competes globally with information technology
11	Case study 3: The TATA NANO makes history using digital manufacturing
12	Case study 4: Jet Airways takes off with CITRIX
13	Case study 5: Karnataka government reposes public trust streamlining treasury operations
14	Case study 6: Procter & Gamble tries to optimize inventory using MIS
15	Project Presentations
16	Project Presentations

COURSE LEARNING OUTCOMES (CLOS) OF LAB FOR IE-401:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
4	Practice Database software's and try to understand case studies	P3	Modern Tool Usage (5)

IE-425– RELIABILITY ANALYSIS

Contact Hours

Theory : 48

Lab : 00

Total : 48

Knowledge Profile: WK6

Credit Hours

Theory : 03

Lab : 0

Total : 03

Semester : Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-425:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe basic concepts of reliability and failure.	C2	Engineering Knowledge (1)
2	To be able to develop models for evaluation of reliability of a component and system.	C3	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To be able to perform testing of reliability.	C5	Investigation(4)

HEC COURSE CONTENT FOR IE-425:

Introduction to Reliability Engineering, Catastrophic failure models and reliability functions, Failure distributions, Failure data analysis, System reliability evaluation techniques, Reliability optimization, Fault tree analysis, Reliability testing; Load-strength interference models.

GRADING POLICY FOR IE-425:

Sessional : 25 %

Mid Term : 25 %

Final Term : 50 %

TEXT BOOKS FOR IE-425:

1. An Introduction to Reliability & Maintainability Engineering by C. E. Ebeling, McGraw-Hill.
2. Reliability in Engineering Design by K. C. Kapur & L. R. Lamberson.

IE-422– LOGISTICS MANAGEMENT

Contact Hours	Credit Hours
Theory : 48	Theory : 03
Lab : 00	Lab : 0
Total : 48	Total : 03
Knowledge Profile: WK68	Semester : Elective

COURSE LEARNING OUTCOMES (CLOS) FOR IE-422:

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
1	To describe basic concepts of supply chain and logistics management.	C2	Engineering Knowledge (1)
2	To determine different logistics parameters and facilities requirement profile	C4	Problem Analysis (2)

CLO No.	Course Learning Outcomes (CLOs)	Taxonomy Domain	PLOs Addressed by Course (PLO No.)
3	To develop logistics plan for organization and customers/users.	C5	Design and Development of Solution (3)

HEC COURSE CONTENT FOR IE-422:

The logistical system of material management, Developing a value based Supply Chain, optimization of Supply Chain, Strategic relationships in logistics, process methodology, Issues concerning marketing channels functions, Determining the facilities requirement profile, Managing logistics facilities. Developing the logistics organization for effective supply chain management, Customer service and Customer retention.

GRADING POLICY FOR IE-422:

Sessional : 25 %

Mid Term : 25 %

Final Term : 50 %

TEXT BOOKS FOR IE-422:

1. Managing the supply chain: A strategic Prospective by J. L. Gattorna and D. W Walters, MacMillan Business Company

2. Logistic and supply chain management: Strategies for reducing costs and improving services by Martin Christopher, Pitmann Publishing Company.

3. Supply Chain Management, Theories & Practices. R. P. Mohanty & S. G. Deshmukh. Biztantra Publishing.