Guru Nanak Dev Engineering College, Ludhiana
(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956
Study Scheme
Ph.D. In Faculty of Civil Engineering
2019 Admission Batch Onwards

Semester										
Category	Code	Course Title	Subject Type (Theory / Practical)	Hours Per Week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
Compulsory	PHRM-101	Research Methodology	Theory	4	0	0	50	100	150	4
Department Specific	PHCE-101	Physico Chemical Treatment Methods	Theory	4	0	0	50	100	150	4
Department Specific	PHCE-102	Advance Structure Analysis	Theory							
Open Elective	PHEL-101	Material technology	Theory	4	0	0	50	100	150	4
Department Specific	PHPR-101	Presentation	Practical	0	0	1	50		50	4
Compulsory	PHEG-101	English for Tech. Writing	Theory	1	0	0	50		50	0
Total				**13**	**0**	**1**	**250**	**300**	**550**	**16**

Physico Chemical Treatment Methods is for Specilization in PhD in Enviornment, Advanced Structre Analysis is for Specilization in PhD in Structre

Prof. & Head of Civil Engg. Deptt.
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Guru Nanak Dev Engineering College, Ludhiana
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Study Scheme
Ph.D. For Faculty in Mechanical Engineering
Sept-Jan 2019 Batch

Semester										
				Hours Per Week			Marks Distribution		Total	
Category	Code	Course Title	Subject Type (Theory / Practical)	L	T	P	Internal	External	Marks	Credits
Compulsory	PHRM-101	Research Methodology	Theory	4	0	0	50	100	150	4
Department Specific	PHME-101	Metal Casting	Theory	4	0	0	50	100	150	4
Open Elective	PHEL-104	Advance Product Design and Development	Theory	4	0	0	50	100	150	4
Compulsory	PHPR-101	Presentation	Practical	0	0	1	50		50	4
Compulsory	PHEG-101	English for Tech. Writing	Theory	1	0	0	50		50	0
Total				**13**	**0**	**1**	**250**	**300**	**550**	**16**

Prof. & Head
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Study Scheme

Ph.D in Faculty of Engineering (Computer Science Engineering)

Sept-Jan 2019

Semester										
Category	Code	Course Title	Subject Type (Theory / Practical)	Hours Per Week			Marks Distribution		Total	Credits
				L	T	P	Internal	External	Marks	
Compulsory	PHRM-101	Research Methodology	Theory	4	0	0	50	100	150	4
Department Specific	PHCS-101	Machine Learning	Theory	4	0	0	50	100	150	4
Open Elective	PHEL-103	Advanced Data Structures	Theory	4	0	0	50	100	150	4
Department Specific	PHPR-101	Presentation	Practical	0	0	1	50		50	4
Compulsory	PHEG-101	English for Tech. Writing	Theory	1	0	0	50		50	0
Total				**13**	**0**	**1**	**250**	**300**	**550**	**16**

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Deptt. of Computer Science & Engineering
Guru Nanak Dev Engineering College,
Gill Road, Ludhiana-141006 (Pb.)

Guru Nanak Dev Engineering College, Ludhiana
(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956
Study Scheme
Ph.D. In Faculty of Electronics and Communication Engineering
Sept-Jan 2019

Semester										
Category	**Code**	**Course Title**	**Subject Type (Theory / Practical)**	**Hours Per Week**			**Marks Distribution**		**Total**	**Credits**
				L	**T**	**P**	**Internal**	**External**	**Marks**	
Compulsory	PHRM-101	Research Methodology	Theory	4	0	0	50	100	150	4
Department Specific	PHEC-101	Advanced Communication Syatem	Theory	4	0	0	50	100	150	4
Open Elective	PHEL-102	Data Warehousing and Data Mining	Theory	4	0	0	50	100	150	4
Department Specific	PHPR-101	Presentation	Practical	0	0	1	50		50	4
Compulsory	PHEG-101	English for Tech. Writing	Theory	1	0	0	50		50	0
Total				**13**	**0**	**1**	**250**	**300**	**550**	**16**

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SUBJECT CODE: PHEL- 104

SUBJECT NAME: ADVANCED PRODUCT DESIGN AND DEVELOPMENT

Programme: PhD (ME)	**L: 3 T: 0 P: 0**
Semester: 1	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Status:** Open Elective

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#.	Course Outcomes (Cos)
1	analyze, evaluate and apply the methodologies for product design, development and management.
2	understand the technical and business aspects of the product development process.
3	apply creative process techniques in synthesizing information, problem-solving and critical thinking.
4	use basic fabrication methods to build prototype models for hard-goods and soft-goods and packaging.
5	skilled in implementation of gathering data from customers and establish technical specification
6	apply technique of PDD Manufacturing.

Detailed Contents:

S.No.	Title	Content details	Credit Hrs.
Unit 1	**Introduction**	Introduction to product design. Classification/ Specifications of Products. Principal requirements of good product design. Importance of product design in industry. Essential factors and considerations affecting product design. Product design methodology and techniques.	**6**
Unit 2	**Visual Design**	Basic elements and concepts of visual design. Materials, forms, function and color relationships. Color theory. Product graphics and different methods of product graphics. Visual communication.	**6**
Unit 3	**Ergonomics**	Human engineering considerations in product design. Human factors in design principles of user-friendly designs. Introduction of ergonomics, man/ machine/environment systems concept. Development of ergonomics. Psychological & physiological considerations.	**6**
Unit 4	**Controls and Displays**	Hand controls and foot controls, location of controls and work place envelope. Recommendation about hand and foot push buttons, rotary selector switches, hand wheels, crank levers etc. Instruments and displays.	**6**
Unit 5	**Material Packaging**	Packaging and function of a package. Packaging materials their characteristics and applications. Packaging design considerations. Modern packaging processes.	**4**
Unit 6	**Value Engineering**	Value engineering, concept, advantage and applications. Value. Types of values. Analysis of function, using and evaluating functions. Value engineering techniques. Value control.	**4**
Unit 7	**Product Development**	Defining new Product and their classification. Product life cycle. New product development process. Product development and testing.	**4**

Text Books:

1. B. W. Niebel and A. B. Draper - Product design and process engineering.
2. Arthur E. Mudge - Value engineering: a systematic approach.
3. Morris Asimov - Introduction to Design.
4. W. H. Mayall - Industrial design for engineers.

Reference books:

1. Hand Book of Maynard's Industrial Engineering - Kjell b. Z andin.
2. Introduction to Product Design and Development for Engineers- Ali Jamnia.
3. Product Design and Manufacture - Wen, Jiuba.

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Head,
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Course Title	**Advanced Communication System**			
Course Code	**PHEC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**4**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Course Outcomes

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

CO1 Comprehend various modulation and demodulation of communication system.

CO2 Describe the concepts of multicarrier scheme.

CO3 Analyse errors in system using optimum receivers and detectors.

CO4 Understand the different types of optical networks.

CO5 Contribute in the areas of software defines radio and cognitive radio.

CO6 Explain the MIMO and channel modelling.

Syllabus

Unit 1. Digital Communication Systems

Introduction to communications systems, digital communication systems, review of digital modulation techniques, BPSK, QPSK, PCM, DPCM, Delta modulation, Single vs Multicarrier Systems, OFDM working and mathematical representation of OFDM signal, pulse shaping and windowing in OFDM signal and spectral efficiency.

Unit 2. Optimum Receivers

Optimum receivers for signals corrupted by additive White Gaussian noise, correlation demodulator, optimum detector. ML sequence detector, probability of error for binary modulation techniques.

Unit 3. Optical Networks

WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solitons

Unit 4. Software Defined Radio

Need for software radio, general structure for transceiver for SDR, third generation SDR system architecture, trends in SDR, cognitive radio, spectrum sensing in cognitive radio.

Unit 5. MIMO Systems

Introduction, space diversity and systems based on space diversity, MIMO based system architecture, MIMO channel modelling, MIMO channel measurement, MIMO channel capacity.

Aneeta Sachdeva

Aneeta Sachdeva

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Text Books:

1. John G. Proakis, "Digital Communication", Prentice Hall India.
2. Wayne Tomasi, "Advanced Communication Systems", Pearson Education India.
3. Uyless Black, "Optical Networks", Pearson Education India.

Reference books and other resources:

1. Upena Dalal, "Wireless Communication", Oxford University Press.
2. S. Haykin, "Digital Communication Systems", Wiley India Edition.
3. Related IEEE/IEE/ Science Direct publications.

Aneeta Sehra

Head of Dept
Electronics & Comm. Engg.,
Guru Nanak Dev Engineering College
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PHCE – 101 Physico - Chemical Treatment Methods **Credits: 4**

	L	T	P
Internal Marks 50			
External Marks 100	**4**	**0**	**0**

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Know the sampling and analysis techniques required for the monitoring of water treatment plants and for the characterization of the water.
2. Understand the water quality guidelines, criteria and standards
3. Evaluate various physical and chemical treatment options for treatment of water and wastewater.
4. Explain the mechanism behind the treatment processes and their advantages and disadvantages.

Syllabus Content:

- **Water – Quality, Standards and Criteria**: Physical, chemical and biological water quality parameters; Water quality guidelines, criteria and standards; Wastewater Effluent standards
- **Purification of water**- Natural treatment processes- Physical, chemical and biological processes. Water treatment technologies- overview. Primary, Secondary and tertiary treatment- Unit operations & unit processes.
- **Screening & Grit removal:** Screens; grit channels, aerated grit chambers;
- **Settling Tanks, Coagulation and Flocculation**: Theory of settling; Types of settling; Settling Tanks; Coagulation - flocculation; Flash mixing tanks and flocculation tanks; Tube settlers and plate settlers.
- **Aeration**: Diffused and surface and gas transfer processes.
- **Filtration Systems**: Filtration theory and filter hydraulics; Slow sand filters; Rapid gravity filters; Pressure filters; Multimedia filters.
- **Disinfection**: Chlorination; Ozonation; UV radiation
- **Other Water Treatment Technologies**: Ion-exchange process; Adsorption process- Adsorption equilibria- adsorption isotherms; membrane processes (nano-filtration, ultra-filtration and reverse osmosis).

Reference Books:-

1. Metcalf and Eddy, "Wastewater Engineering – Treatment and Reuse", Tata McGraw Hill.
2. Syed R. Qasim, Edward Motley, Guang Zhu, "Water Works Engineering"- Planning, Design and Operation, PHI
3. Weber W.J., "Physico-chemical Processes for Water Quality Control", John-Wiley
4. Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, "Environmental Engg.", McGraw Hill
5. Viessman Jr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning
6. Hammer, M.J. and Hammer, M.J. Jr., "Water and Wastewater Technology", PHI Learning

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PHCE – 102 Advance Structure Analysis **Credits: 4**

Internal Marks 50	**L**	**T**	**P**
External Marks 100	**4**	**0**	**0**

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Develop Stiffness and flexibility matrices for skeletal structural systems.
2. Analyze and evaluate the response of skeletal structural systems using force method.
3. Analyze and evaluate the response of skeletal structural systems using displacement method.
4. Apply member approach for analyzing higher order skeletal structural systems.
5. Illustrate the use of matrix methods for analyzing skeletal structural systems subjected to secondary stresses due to lack of fit, temperature change and differential settlement.
6. Comprehend and apply finite element approach for solving boundary value problems.

Syllabus Content:

- **Application of Stiffness and Flexibility Methods:** Stiffness Matrix and Flexibility matrix in Local & Global Coordinates, Boundary Conditions, Solution of Matrix Equations, Calculation of Reactions and Member Forces; Analysis of Beams, Trusses, Rigid-Jointed Frames and Grids using the Structure Approach and the Member Approach
- **Influence Coefficients:** Physical Significance and use in structural analysis & design, their deviation for different structural elements/members; Effects of support settlements, Temperature change and Lack of Fit using the Member Approach and the Structure Approach
- **Boundary Value Problems**: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional problems, Matrix Formulation of the Modified Galerkin Method and its applications

Reference Books:

1. Matrix Analysis of Framed Structures, Weaver W, and Gere J. M., Van Nostrand Reinhold Company
2. Structural Analysis - A Matrix Approach, Pandit G.S. and Gupta S. P., Tata McGraw Hill
3. The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co.
4. Computer Methods in Structural Analysis, Meek J. L., CRC Press
5. Introduction to Finite Element Method, Desai and Able, CBS Publishers

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Course Code	PHEL-103
Course Name	**ADVANCED DATA STRUCTURES**
Credits (L-T-P)	4 (4-0-0)
Total Number of Lectures	40
Syllabus Contents	
Teaching Scheme	4 hours/week

LECTURE WITH BREAKUP	**No. of Lectures**
Unit 1 **Hashing and Skip Lists** Hashing :- Introduction, Static Hashing – Hash table, Hash Function ,overflow Handling, Dynamic Hashing Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists	8
Unit 2 **Trees**: Binary Search Trees, AVL Trees, Red Black Trees, B- Trees, B+-Trees, Splay Trees, Digital Search Trees, Analysis of search trees.	8
Unit 3 **Heap :** Binary Heaps, d-Heaps , Leftist Heaps , Skew Heaps , Binomial Heaps , Fibonacci Heaps, Analysis of heaps.	8
Unit 4 **Text Processing:** Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, The Huffman Coding Algorithm, Tries- Standard Tries, Compressed Tries, Suffix Tries, Analysis of text processing algorithms.	8
Unit 5 **Multidimensional Searching:** Range Trees, Priority Search Trees ,Quad trees, k-D Trees	8

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson, 2004.
2. Michael T Goodrich, Roberto Tamassia, Algorithm Design and Applications, John Wiley, 2002.
3. Michael T Goodrich, Roberto Tamassia, Algorithm Design, Data Structures and Algorithms in C++,Second Edition John Wiley & Sons, Inc., 2011.
4. Ellis Horowitz ,Dinesh Mehta ,Sartaj Sahni ,Fundamentals of Data Structures in C++, University Press

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H.O.D.
Deptt. of Electrical Engineering
G.N.D. Engineering College,
Ludhiana-141 006.

NO:-PE/C-10/1710
Dt:-13-11-19.

SUBJECT CODE: PHEL-101
SUBJECT NAME: MATERIAL TECHNOLOGY

Programme: Ph.D.(ME)	**L:** 4 **T:** 0 **P:** 0
Semester: 3	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Status:** Compulsory

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#.	Course Outcomes (Cos)
1	apply knowledge of Crystal growth, Crystal structure, re-crystallization in various manufacturing processes.
2	recall the properties of materials by viewing the microstructure.
3	analyze the defects and various causes for the failure of the material.
4	select the best suitable material in accordance with the advancements in technology.
5	predict the phase transformation at different temperature and composition.
6	evaluate the behaviour of material under various environmental conditions.

Detailed Contents:

S.No.	Title	Content details (Part A)	Credit Hrs.
Unit 1	**Introduction**	Classification of Engineering materials; their mechanical behavior, testing and manufacturing properties of materials; physical properties of materials; Non-destructive testing techniques.	**4**
Unit 2	**Atomic structure**	Atomic structure of metals, crystal structure, crystal lattice of (i) Body centered cubic (ii) face centered cubic (iii) closed packed hexagonal, crystallographic notation of atomic planes, polymorphism and allotropy, Solidification of crystallization (i) nuclear formation (ii)crystal growth (iii) crystal imperfection. Elementary treatment of theories of plastic deformation, phenomenon of slip. Twinning. Dislocation. Identification of crystallographic possible slip planes and direction in F.C.C. B.C.C. C.P.H., recovery, re-crystallization, preferred orientation causes and effects on the property of metals	**8**
Unit 3	**Mechanical behavior of materials**	Stress-Strain behavior (Engg. and True stress-strain curves), Yield and Ultimate strength, Anelasticity, Viscoelastic materials, Stress relaxation, Ductile fracture, Brittle fracture, Ductility, Impact strength, Toughness (Impact, tensile and fracture toughness), Ductile-to-brittle transition.Fatigue: Introduction, Terminology, S-N diagram, Stages of fatigue failure, Design for fatigue loading, Factors affecting fatigue life. Creep: Definition, Creep curve, Stages of creep, Creep laws, Factors affecting creep, Mechanisms of creep, Materials for creep resistance.	**8**
		Part B	
Unit 4	**Phase Transformation**	General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary system in which the components form a mechanical mixture of crystals in the solid state and are completely mutually soluble in both liquid state. Equilibrium diagrams of a systems whose components have complete mutual solubility in the liquid state and limited solubility in the solid state and in which the solid state solubility decreases with temperature; Equilibrium diagram of alloys whose components have complete mutual solubility in the liquid state and limited solubility in solid state (Alloy with a peritectic transformation) Equilibrium diagrams of a system whose components are subject to allotropic change. Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram: (i) Formation of Austenite (ii) Transformation	**8**

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		of austenite into pearlite (iii) Martensite transformation in steel, time temperature transformation curves.	
Unit 5	**Advanced materials**	COMPOSITE MATERIALS: Introduction, Classifications, Advantages and applications of composites, Fibers and matrix materials and their properties, Introduction to nano-composites. CERAMIC MATERIALS: Introduction, Properties, Classification, Silicate ceramics, Silicate sheet and chain structures. NANO STRUCTURAL MATERIALS: Introduction to Carbon Nano Tube (CNT), Classification of CNT, Production methods for CNT, Applications of CNT.	**4**
Unit 6	**Environmental Degradation of materials**	Corrosion and its control, Oxidation and its mechanism, Oxidation kinetics, Control of oxidation. Wear and its types, mechanisms, Prevention and control of wear.	**4**

Text Books

1. Engg. Physical Metallurgy by Y. Lakhtin, (Mir Publishers)
2. Heat Treatment of Metals by B. Zakharv (Peace Publishers)
3. Engineering Metallurgy by V. Raghavan (PHI Learning Pvt. Ltd)
4. Introduction to Physical Metallurgy by Avner (Tata McGraw Hill)
5. Material Science & Metallurgy by O.P Khanna (DhanpatRai& Co.)

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PHCS-101 MACHINE LEARNING

Internal: 50
External: 100

L	T	P
4	0	0

Introduction: Well defined learning problems, Defining a learning system, perspectives and issues in machine learning, the concept learning task, concept learning as search, Find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Inductive bias

Supervised Learning: Basic methods: Distance based methods, Nearest- Neighbours, Decision Trees, Naive Bayes, and Linear models: Linear regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and kernel Methods

Unsupervised Learning: Clustering: k-means/ kernel k-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative models (mixture models and latent factor models)

Decision Tree Learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, issues in decision tree learning

Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, perceptrons, gradient descent and the delta rule, Adaline, Multilayer networks, Derivation of Back propagation rule, back propagation algorithm

Bayesian Learning: Introduction, Bayes theorem and concept learning, Maximum likelihood and least squared error hypothesis for predicting probabilities, minimum description length principle, Bayes optimal classifier, Naive bayes classifier, Bayesian belief networks

Genetic Algorithms: Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning

COURSE OUTCOMES

On completion of course the student should be able to

CO1	Learn the basics of learning problems with hypothesis and version spaces
CO2	Understand the features of machine learning to apply on real world problems
CO3	Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning
CO4	Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5	Learn the concepts in Bayesian analysis from probability models and methods
CO6	Understand the fundamental concepts of Genetic Algorithm and Analyze and design the genetic algorithms for optimization engineering problems

Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, First Edition.
2. Ethern Alpaydin, Introduction to Machine Learning, MIT Press, 3rd Edition.
3. Chris Bishop, Pattern Recognition and Machine Learning, Springer.
4. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2nd Edition

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Deptt. of Computer Science & Engineering
Guru Nanak Dev Engineering College,
Gill Road, Ludhiana-141006 (Pb.)

PHEL-102	Data Warehousing and Data Mining	4L:0T:0P	4 Credits	Total Hours: 40

Internal Max Marks: 50
External Max Marks: 100
Total: 150
Pre-requisites: Knowledge of Database Management System

Course Outcomes:

After studying this course the student will be able to

1. Understand Data Warehouse fundamentals, Data Mining Principles
2. Design data warehouse with dimensional modelling and apply OLAP operations.
3. Identify appropriate data mining algorithms to solve real world problems
4. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
5. Describe complex data types with respect to text and web mining.
6. Benefit the user experiences towards research and innovation.

Detailed Contents

Module 1: Data Warehousing: Data Warehouse Concepts, Benefits, comparison OLTP and Data warehouse, Problems in DWH, Architectures of DWH, Data Mart, Reasons for creating Data Mart.

Data warehouse design: Dimension Modelling, Fact Table, Schemas for data warehouse, Steps to create data warehouse, Data Warehouse Design Practices and Methodologies, Data Integration Concepts, Details of Data Integration Tools. OLAP: Online Analytical Processing, OLAP cube, OLAP operations types of OLAP: ROLAP, MOLAP, Hybrid OLAP, Advantages & Disadvantages, OLTP vs OLAP. [14 hrs]

Module 2: Data Mining: Introduction to Data mining and knowledge discovery, Know your Data, Data Pre-processing, Mining frequent patterns, associations and correlations: Basic concepts and methods, Classification: Basic concepts, Classification algorithms, Clustering: Basic Concepts, Clustering algorithms, Cluster analysis: Basic Concepts and methods, outlier detection.: [20 hrs]

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12/11/19

PHRM-101: RESEARCH METHODOLOGY

Internal Marks: 50 **L T P**
External Marks: 100 **4 0 0**
Total Marks: 150

Overview of Research: Nature and Objectives of research, historical, descriptive and experimental, Study and formulation of research problem, Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal.

Methods of Data Collection: Primary data and Secondary Data, methods of primary data collection, classification of secondary data.

Sampling Methods: Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions.

Processing and Analysis of Data: Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses, Parametric (t, z and F) Chi Square, ANOVA. Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis.

Design of Experiments: Basic principles, study of completely randomized and randomized block designs. Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography.

Note: Application and use of various software for case studies should essential be covered in the lectures.

Recommended Books

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, N.Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
5. Stoufferetal, Measurement & Prediction, Wiley, N.York
6. J.W Bames, Statistical Analysis for Engineers & Scientists, McGraw Hill, N.York
7. Donald Cooper, Business Research Methods, Tata McGraw Hill, N.Delhi

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PHME-101 METAL CASTING

Internal : 50 External : 100

4 Credits

Structure of silica and different types of clays, bonding mechanism of silica — water-clay systems. Swelling of clays, sintering adhesion and colloidal clay; silica grain shape and size distribution standard permeability A.F.S. clay (8 Hours)

Characteristics, Ingredients and additives of moulding sand, core sands. (3 Hours)

Solidifications of Metals, nucleation, free energy concept, critical radius of nucleus. Nucleation and growth in metals and alloys. constitutional super cooling. Columnar equiacquiesced and dendritic structures. Freezing of alloys centreline feeding resistance. Rate of solidification, time of solidification, mould constant. Fluidity of metals, volumes re-distribubon. Analysis of the process. (10 Hours)

Riser design shape, size and placement. Effect of appendages on risering. Effective feeding distances for simple and complex shapes. Use of chills, gating design, filling time. Aspiration of gases. Top, bottom and inside gating. Directional solidifications stresses in castings. Metal mould reactions. Expansion scale and metal penetration. Analysis of the process (10 Hours)

Various moulding and casting processes, hot box, cold box process, investment, shell moulding, full mould process, die casting, ceramic shell mould, vaccum moulding etc. (6 Hours)

Non-ferrous Die-casting of Aluminium and its alloys, brass and bronze. (3 Hours)

Books:

1. Fundamentals of Metals Casting by Flimm; Addison Wesley.
2. Principles of Metal Casting by Heine Loper and Resenthal; MeGraw Hill.
3. Product Design & Process Engineering by Hielel and Draper; Mcgraw Hill.
4. Foundry Practice by Sahnan & Simans; Issae Pitman.
5. Metals Handbook- Metal Casting; ASME.

Note: Eight questions ont of entire syllabus and well-distributed are to be set; students are required to attempt 5 questions.

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Syllabus of Effective Technical Writing-(PHEG-101)

UNIT-A

1. **Report Writing**: Structure of Technical Report, Presentation, Planning the Report, The Report Layout, Styles of Report

2. **Art of Condensation**: Introduction, Précis, Summary, Abstract, Synopsis, Paraphrasing, Some Working Principles of Condensation

3. **Punctuation: The Comma** – Listing Comma, Joining Comma, Gapping Comma, Bracketing Comma; Comparison of the Colon and the Semicolon; Hyphen and Dash; The Ellipsis, The Slash, Diacritics, Priority Among Punctuation Marks

UNIT-B

4. **Presentation Skills**: Types of Presentation, Rules, Techniques, Presenting Under Particular Circumstances, Structuring a Presentation

5. **Processes and Guidelines in Technical Writing**: Writing Process: From Audience to Rough Draft, Audience Analysis, Task Analysis, Basic Patterns and Elements of the Sentence, Power-revision Techniques

6. **Sentence Structure**: Simple, Compound and Complex Sentence, Parallel Construction, Relative, Restrictive and Non-restrictive Clauses, Subject-Verb Agreement, Transitive and Intransitive Verbs

Amandeep Singh Bal
Asst. Professor
Dept. of Applied Science

HOD (Applied Science)