# Centurion University of Technology and Management Odisha

## Choice Based Credit System

**Course Structure & Syllabus**

# Mechanical Engineering

**CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT**

**School of Engineering & Technology**

**2022**

**Basket IV**

**Core Courses**

**Mechanical Engineering**

| Course Code | Course Title | Credits | Type T+P+PJ | Prerequisite |
|---|---|---|---|---|
| CUTM1075 | Computer Aided Drafting | 3 | 0-2-1 | |
| CUTM1076 | Product Design and Development | 2 | 1-1-0 | |
| CUTM1077 | Reverse Engineering and Rapid Prototype | 4 | 1-2-1 | |
| CUTM1078 | Product Life Cycle Management | 2 | 0-1-1 | |
| CUTM1604 | Manufacturing Process | 3 | 2-1-0 | |
| CUTM1080 | Material in product design and development | 2 | 1-10 | |
| CUTM1081 | Computer Aided Engineering | 3 | 0-2-1 | |
| CUTM1082 | Quality Assurance | 2 | 1-1-0 | |
| CUTM1083 | Applied Ergonomics | 2 | 0-1-1 | |
| CUTM1084 | Computer Aided Manufacturing | 2 | 0-2-0 | |
| CUTM1085 | CNC Programming & CNC Machining | 2 | 0-2-0 | |
| CUTM1086 | Design of Tools, Jigs and Fixtures | 3 | 2-1-0 | |
| CUTM1087 | Advance Metrology | 2 | 1-1-0 | |
| CUTM1088 | Thermodynamics | 3 | 2-1-0 | |
| CUTM1089 | Fluid Mechanics with Finite Volume Method | 3 | 2-1-0 | |
| CUTM1090 | Hydraulic Machinery | 2 | 1-1-0 | |
| CUTM1091 | Theory of Machines | 3 | 2-1-0 | |
| CUTM1092 | Heat Transfer with FDM/FVM | 3 | 2-1-0 | |
| CUTM1062 | Theories of Failure Using Finite Element Analysis | 4 | 2-2-0 | |
| CUTM1079 | Optimisation Techniques | 2 | 0-2-0 | |
| CUTM1058 | Programming in Java(Same as Java Technologies) | 3 | 2-1-0 | |

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|---|---|---|---|---|
| CUTM1059 | Database Management Systems | 3 | 2-1-0 | |
| | **Total Credits** | **58** | | |

## Basket IV Core Courses Syllabus

### Computer Aided Drafting

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1075 | Computer Aided Drafting | 3 | 0-2-1 |

**Objective**

- How to create simple parts, assemblies and drawings.
- How to use different feature-based tools to build, review and modify a model.
- How to create and analyze assemblies and how to produce a drawing with different views.
- How to dimension the drawing and annotate the views.

**Course outcome**

- Students will be able to use CATIA for creation of 3D models, Assembly Designs and Drawings

**Course content**

**Module I: Sketcher - Creating Profiles** **2 (hrs)**

PLM Objects, Sketch Support, Simple elements, constraining sketches, simple and complex profiles, transforming sketches, saving documents

**Practice-1** : Hands on Session on Sketcher Workbench

**Module II: Part Design -Creating Basic Features** **5 (hrs)**

Extruded Features, revolved features, holes, threads, taps, drafts, fillets, chamfers, shelling and stiffeners, relational dimensions,

**Practice-2** : Hands on Session on Sketch Based Features & Dress Up Features

**Practice-3:** Hands on Session on Transformation Features

**Module III: Reviewing & Modifying** **2 (hrs)**

Measuring the model, re using the data, editing features

**Practice-4:** Hands on Session on Measuring Tools & Editing Features

**Module IV: Finalizing Design** **5 (hrs)**

Adding parameters, reusing features, rendering, weight calculation,

**Practice-5:** Hands on Session on Parametric Design

**Practice-6:** Hands on Session on Rendering, Material Addition

**Module V: Creating & Managing Products** **6 (hrs)**

Positioning Components, constraining Components, Analyzing weight distribution, replacing and revising parts

**Practice-7:** Hands on Session on Assembly Design

**Practice-8 :** Hands on Session on Digital Mock Up

**Module VI: Creating Drawings** **4 (hrs)**

Creating Drawing, Modifying, dimensioning, Annotations, Finalizing & Printing

**Practice-9 :** Hands on Session on Drawing Conventions

**Practice-10:** Hands on Session on Creating Drawings

**Module VII: Master Exercise** **(5 hrs)**

Heat Sink , PC Card Slide

**Practice-11 :** Modeling of Heat Sink

**Practice-12:** Modeling and Assembly of PC card Slide

Text Books:

1. Mechanical Design Fundamentals : DassaultSystemes Companion Learning Space Material

Reference Books:

**Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester**

## Product Design & Development

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1076 | Product Design & Development | 2 | 1-1-0 |

**Objective**

- Understand modern product development processes.
- Understand and explain the concept of Industrial design and robust design concepts.
- Understand the concept of Design for manufacture and assembly.
- Understand the legal factors, social issues, engineering ethics related to product design

**Course outcome**

- Prepare primary designs taking into consideration all relevant ergonomics and aesthetic aspects of the product.

### Course content

**Module I: Introduction** **2 (hrs)**

Introduction to product design, Morphology of design, Modern product development process, Innovative thinking

**Module II: Conceptual** **3 (hrs)**

Generation, Selection and embodiment of concept, Product Architecture

**Practice 1:** Concept Design using 3D Experience Platform

**Module III: Industrial** **5 (hrs)**

Process and need, Robust design concepts: Taguchi Design and DOE, case studies on various robust design concepts

**Practice 2:** Failure Analysis through Simulia - Structural Analysis,

**Practice 3:** Thermal Analysis using Simulia

**Module IV:** **3 (hrs)**

**Optimization** Optimization using 3D Experience- Function Generative Design

**Practice 4:** Shape Optimization using 3D Experience

**Module V: Design for Manufacturing & Assembly 3 (hrs)**

Methods, Design for Maintainability, Designs for Environment, Product costing

**Practice 5**: Assembly Design Review using 3D Experience

**Module VI: Value Engineering & Analysis 3 (hrs)**

Definition, Methodology & Case Studies, Economic analysis: Qualitative & Quantitative

**Module VII: Ergonomics & Aesthetics 3 (hrs)**

Gross human autonomy, Anthropometry, Man-Machine interaction, Concepts of size and texture, color, Comfort criteria, Psychological & Physiological Considerations

**Practice 6 :** Human Ergonomics using 3D Experience

Text Books:


2. Engineering Design , George E.Dieter, Fourth Edition, McGraw Hill
3. Chitale, A K, Product Design & Manufacturing, 2013, 6th Edition, PHI publication, India


Reference Books:


1. DassaultSystemes Companion Learning Space Material on Product Design
2. DassaultSystemes Companion Learning Space Material on Function Generative Design
3. DassaultSystemes Companion Learning Space Material on Virtual Ergonomics Simulation Fundamentals- Delmia Ergonomics at Work

## Reverse Engineering & Rapid Prototype

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1077 | Reverse Engineering & Rapid Prototype | 4 | 1-2-1 |

**Objective**

- Understand concept of reverse engineering
- Understand principles of imaging, cross-sectional scanning, digital data, computational graphics
- Understand legality of reverse engineering concept

**Course outcome**

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- Use the Digitized Shape Editor (DSE) workbench
- Import and process the digitized data (scans or clouds of points),
- Quick Surface Reconstruction (QSR) from the digitized data.
- Create a mesh and extract characteristic curves to create surfaces using point cloud data

**Course content**

**Module I: Introduction to Reverse Engineering 2 (hrs)**

Historical Background & Industrial Evolution,Reverse Engineering in Modern Industries, Motivation and Challenge, Analysis and Verification, Applications of Reverse Engineering & 3D scanning.

Practice :1 Generate a Model from a Product

**Module II: Processing the Point data & Creating Tessellated Mesh 2 (hrs)**

Stages in the Process, Introduction to Digitized shape editor, Importing the Point data, editing the cloud, Creating & Correcting the mesh, editing the mesh, creating tessellated mesh

Practice:2 Cloud Point Generation

Practice :3 Mesh Generation from Cloud Point data

**Module III: Curve Creation & Processing 2 (hrs)**

Stages in the Process, creating and editing scans, creating curves, Additional tools, Introduction to quick surface reconstruction, creating scans by segmentation, processing curves

Practice : 4 Curve Generation

**Module IV: Creating Surface** **2 (hrs)**

Stages in the Process, creating surface, using automatic processes, checking deviations

Practice :5 Surface Generation & Optimization

**Module V : Additive Manufacturing** **2 (hrs)**

Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology,Classification – Stereo lithography Apparatus (SLA)- Principle, process, advantages –Fused Deposition Modeling – Principle, process, advantages.Selective Laser Sintering – Principle, Process, advantages, Three Dimensional Printing – Principle, process, advantages - Laser Engineered Net Shaping (LENS)

**Module VI :Delmia Additive Part Preparation Essentials**

Preparing Infrastructure, Preparing Parts, Managing Rules, Generating the Slicing Path,

Practice : 6 Prepare a part for 3D Printing

**Module VII: Master Project** **2 (hrs)**

Reverse Engineering of the Car Fender and 3D Printing

Text Books:

1. DassaultSystemes Companion Learning Space : Catia Reverse Engineering Essentials

Reference Books:

## Product Life Cycle Management

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1078 | Product Life Cycle Management | 2 | 0-1-1 |

**Objective**

- Use ENOVIA Engineering BOM Management
- Create parts and specifications
- Create Change Orders

**Course outcome**

- Manage the engineering change process
- Raise Change Requests for the parts and specifications
- Generate various types of reports.

### Course content

**Module I: Introduction** **3 (hrs)**

Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application

**ModuleII: ENOVIA** **2(hrs)**

Getting Started, Working with Parts, Creating & Attaching Specifications

**ModuleIII:EBOM** **2 (hrs)**

Creating Engineering Bill of Materials

**ModuleIV:ECM** **2 (hrs)**

Releasing parts using Enterprise Change Management, Reports

**Module V: Collaborative Life Cycle Management** **4 (hrs)**

Getting Started, Creating a Product Structure, Managing the Structure

**Module VI: 3D Tolerancing& Annotation** **3 (hrs)**

Dimensions &Tolerances , Assembly Specifications, Validate Annotations, Generate Drawings, Review through 3D Play.

**Module VII: Master Project**

**3(hrs)**

Master Project on ENOVIA EBOM Management

*Text Books:*

1. DassaultSystemes Companion Learning Space- ENOVIA EBOM Management
2. DassaultSystemes Companion Learning Space- Collaborative Lifecycle Management
3. DassaultSystemes Companion Learning Space- 3D Tolerancing& Annotation

## Manufacturing Process

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1604 | Manufacturing Process | 3 | 2-1-0 |

**Objective**

- To Understand the Importance of Materials, Manufacturing Processes, Process Planning & Design in Product Manufacturing

**Course outcome**

- Select Engineering Material for a Required Purpose
- Identify Various Manufacturing Processes
- Implement Modern Approaches to Process Planning, Product Design & Development

### Course content

**Module I: Classification of Materials (5hrs)**

**Common Engineering Materials**; **Crystal Geometry** ( Crystal Types, Crystal Structures and Defects, Recrystallization, Methods of Determining Crystal Structure, Scanning Electron Microscope.

Practice:

1. Tensile, Hardness and Impact Testing of Materials

**Module II: Tool Materials (4hrs)**

**Engineering Alloys** (Selection and Specification of Carbon and Alloy Steels for General Engineering Purpose, Specification of Materials as per Various Standards- IS, BS, AISI, APS etc.); **Steels** (Case Hardening Steels, Cold Work Tool Steels, Hot Work Tool Steels, High Speed Tool Steels; **Modern Cutting Tool Materials** (Carbide, Coated carbides, Ceramics, CBN, Diamond, SiALON, Impregnated tools); **Cast Iron** (Grey Iron Casting IS: 210 SG Cast Iron IS: 865, Malleable Iron Castings IS: 2108 and IS: 2640); **Non-Ferrous Alloys** ( Zn & Al Alloys); **Powder Metallurgy** (Methods for Production of Powders, Powder Metallurgy Steps).

**Module III: Heat Treatment (4hrs)**

**Heat Treatment of Steel** (Annealing, Normalizing, Hardening, Tempering, Surface hardening**) ; Heat Treatment Defects**

**Module IV: Manufacturing Processes (8 hrs)**

**Forming Processes** (Cold & Hot Working, Rolling, Forging, Drawing, Bending & Extrusion)**;** **Joining Processes** (Arc Welding, Gas Welding, Resistance Welding, Thermit Welding, TIG & MIG Welding, LBW, EBW, Adhesive Bonding, Soldering & Brazing,)**;**

**Casting Process**(Sand Casting, Die Casting, Investment Casting, Centrifugal Casting, Vacuum Casting, Plaster Mould Casting, Lost Foam Method, Continuous Casting).

Practice:

2. Pattern & Mold Making in Sand Casting.
3. Butt Joint by using Oxy Acetylene Gas Welding.
4. Joining of Metal Sheets using Spot Welding.
5. Soldering & Brazing Practice.
6. TIG Welding of Stainless Steel
7. MIG Welding Technique and Applications

**Module V: Machining Processes (6 hrs)**

**Conventional Machining Processes:** Turning, Milling, Drilling, Shaping, Grinding & Finishing; **Unconventional Machining Processes:** EDM. AJM, LBM etc.); **Rapid Prototyping**

8. EDM working Principle and Process Parameters
9. Demonstration of 3D printing with FDM

**Module VI: Process Planning (5 hrs)**

**Process Planning** (Concept, Manufacturing Planning, Process Design, Process Planning Activities, Process Sheet, Process Selection Parameters, Steps in Process Planning, Computer Aided Process Planning)

Practice

10. Process Planning & Simulation in DELMIA

**Module VII: Computer Aided Production Management (8 hrs)**

**Role of Computer in Product Design and Management**(Computer in Manufacturing & Design Process, Creation of Manufacturing Data Base, Computer Integrated Manufacturing, Communication Network, Production Flow Analysis, Group Technology);

**Process & Product Design** (Degree of Accuracy, Finish and Tolerance, Capability Studies, Basic Product Design Rules for Casting, Forging, Machining, Sheet Metal and Welding. Physical Properties of Engineering Materials and their Importance on Products, Selection of Plastics, Rubber, Composites and Ceramics for Product Design)

Practice

11. Casting Design & Analysis using CATIA
12. Forging Design & Analysis using CATIA

Text Books:

1. Balasubramaniam R.,''Callister's Materials Science and Engineering", 2nd Edition, Wiley.
2. Rao P.N., "Manufacturing Technology", Volume 1, Mc-Graw Hill.
3. Chitale A.K.,Gupta R.C.''Product Design & Manufacturing", 6th Edition, PHI Learning.

Reference Books:

1. Campbell F., "Elements of Metallurgy and Engineering Alloys", ASM International.
2. Kesavan R., Elanchezhian C., Vijaya Ramnath B., "Process Planning & Cost Estimation", New Age International.

## Material in Product Design and Development

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1080 | Material in Product Design and Development | 2 | 1-1-0 |

**Objective**

- Identify and select suitable material for product design.
- Understanding various material selection for manufacturing processes
- Application of smart materials, shape memory metals, Nano materials.
- Understand the concept of bio materials.
- Understand concept of smart and hybrid materials.

**Course outcome**

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- Understand the concept of elastic and plastic deformation.
- Identify and select suitable material for product design.
- Understand manufacturing characteristics of materials
- Understanding various manufacturing process.
- Understanding Application of smart materials, shape memory metal, Nano material.
- Understood the concept of smart and hybrid materials.

**Course content**

**Module I: Classification of materials ( 2 hrs)**

Introduction to material classification, Steel, Stainless Steel & Types, HSLA Steels, Dual Phase Steels, Tool and Die Steels. Nonferrous Alloys- Aluminum & Alloys, Copper & Alloys, Zinc & alloys, Nickel & Alloys , Magnesium Alloys, Titanium Alloys, Super Alloys.

**Module II : Material behavior (10 hrs)**

Elastic and Plastic deformation- Mechanism of Plastic deformation-yield stress and shear strength-Perfect and Real crystals- Effect of strain rate and temperature on plastic behavior- Super plasticity- Deformation of non crystalline materials

Expt-1 - To study Creep transient for different materials using virtual lab.
Expt-2: To study the effect of obstacle distance on the creep transient behavior of materials using virtual lab.
Expt-3: To evaluate modulus of elasticity of materials using nano indentation using virtual lab.
Expt-4: To find indent depth on materials using nano indentation.
Expt- 5-To find out plastic work done during nano indentation.

**Module III: Material Selection for Process modeling and product design ( 4 hrs)**

Material selection- Cost and service requirement- Recycling- Selection of material for mechanical properties- Strength, toughness and fatigue- Material selection for durability and surface wear and Corrosion resistance- Functional relation between materials and processing- Manufacturing characteristics of metals- Material selection using Ashby charts and other aids material selection for aero, auto and nuclear application- Case studies in material selection.

Expt-6- Practice on material selection using Ashby charts
Expt-7- Case study on material selection for bicycle frame using material chart.
Expt-8- Case study on material selection for car brake using material chart.
Expt-9- Case study on material selection for Knee implant.

**Module III: Shape memory Alloys and Nano materials (3 hrs)**

Introduction to Smart materials and its applications, Shape memory metals and its applications, Introduction to Nano-materials, CNTs Production Process and Uses, Fibers Production and Uses. Introduction to bio materials.

Expt-10- To imagine the cytoskeleton of cells proliferation on bio materials Surface.

**Module IV: Polymer Composite materials (3 hrs)**

Polymer- Thermosetting, Thermoplastics; Elastomers- Natural & Synthetic Rubber; Composites Material- Classification Based on Matrix and Topology, Particle Reinforced Composites, Fiber Reinforced Composites. Structural Composites, Constituents of Composites, MMC, PMC and FRP. Ceramic Composites, Geo synthetics, Pre-stressed Hollow Concrete Panel, Carbon Composites Fullerenes, Bucky Ball Structures, Grapheme.

**Module V: Prefab materials ( 2 Hrs )**

Prefabricated Materials: Types and Applications, Autoclaved Aerated Concrete (AAC), Cellular Lightweight Concrete (CLC).

**Module VI: Developments in material processing (3 hrs)**

Introduction to Microelectro mechanical Systems (MEMS) and its applications, Micro fabrication technologies- Tool for micro fabrication- Diamond and high speed machining- LIGA micro fabrication process- Multilayer X-ray lithography-

**Module VII: Introduction to smart /intelligent and Hybrid materials (3 hours)**

Overview of Smart / Intelligent Materials, Primitive Functions of Intelligent materials, Intelligence Inherent in Materials, Actuator Materials, Sensing Technologies, Micro-sensors, Intelligent Systems, Hybrid Smart Materials, Passive Sensory Smart Structures, Reactive actuators based smart structures, Active Sensing and Reactive Smart Structures, Smart Skins

Practice :
1. Virtual lab by IIT kanpur.

**Text Books:**
1. Materials Science and Engineering, W D Callister,2014, 2nd Edition, Wiley India Private Limited, India.

**Reference Books**:
1. Material Science and Engineering, V Raghavan, 2013, 5th Edition, PHI publication, India.
2. Material Science and Engineering, S Chawla, 2011, 1st Edition, Dhanpat Rai & co Private Ltd., India.

## Computer Aided Engineering

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1081 | Computer Aided Engineering | 3 | 0-2-1 |

**Objective**

- This course will help student to use structural scenario, thermal scenario and to do Structural analysis and Thermal analysis of various problems.

**Course outcome**

- Create complete finite element models
- Submit and monitor analysis jobs
- View and evaluate simulation results

### Course content

**Module I: Material and Selection Properties (6 Hrs)**

Property Module, Material Definitions, Linear Elasticity, Large Strain Elasticity, Metal Plasticity, Material Calibration, Material Databases, Section Properties

**Practice:**

1. Analysis of crack in pressure vessel
2. Cable stayed bridge simulation

**Module II: Element Selection Criteria (6 Hrs)**

Solid Element Selection, Structural vs. Continuum Elements, Modeling Bending UsingContinuum Elements, Stress Concentrations

**Practice**:

3. Stress analysis of rail road with wheel.
4. Bike frame structural analysis

**Module III: Meshing (8 Hrs)**

Mesh Module, Mesh Elements Mesh Generation Workflow, Local Fine-tuning

Quality Checks, Mesh Compatibility, Mesh Convergence, Dependent and Independent Part Instances

**Practice:**

5. Airplane bracket structural analysis
6. Structural analysis of wind turbine blade

**Module IV: Boundary Condition (6 Hrs)**

Step Module, Analysis Steps and Procedures, Output Requests, Output Files

Load Module, Loads and Boundary Conditions, Initial Conditions

**Practice:**

7. Generative structural analysis applied for design optimization
8. Stress analysis on a backhoe

**Module V: Contact (6 Hrs)**

Mechanical Contact Properties, Contact Domain, Contact Formulation and Controls, Handling Initial Over closures, Contact Output

**Practice:**

9. Analysis of Economizer.
10. Analysis of Screw Jack

**Module VI: Analysis Procedures (6 Hrs)**

Model and Analysis Steps, Analysis Procedures, The static, general analysis procedure, Finding a converged solution, The Static, Linear Perturbation procedure, Buckle procedure, Frequency Procedure, The dynamic, explicit analysis procedure, Stability Limit, Analysis Continuation Techniques

**Practice:**

11. Steady state analysis of a composite bar.

**Module VII: Thermal Analysis (8 Hrs)**

*S*teady State Heat Transfer, Transient Heat Transfer, Thermal Interfaces, Thermal Stress Analysis

**Practice:**

12. Temperature distribution in radiators used in automobiles
13. Oven radiation simulation

14. Steady state thermal analysis of tungsten coil with internal heat generation
15. Thermal analysis of disc brake

**Projects**

1. Thermal Analysis of PV Solar Pannel
2. Structural and thermal analysis of Green House
3. Structural analysis of Quadcopter.
4. Structural analysis of landing gear.
5. Numerical study on different types of fins.
6. Overhead tank failure analysis.
7. Analysis of Rocket Nozzle
8. Analysis of BAJA SAE
9. Structural and Thermal Analysis of Downdraft Gasifier
10. Structural and Thermal Analysis of Stirling Engine
11. Structural Analysis of Hydraulic Press
12. Structural Analysis of Elevating Conveyor

*Text Books/ Reference Books/ Reference Material*

1. SIMULIA: 3DS Learning Space

***Source of reference: 3DS peer learning***

## Quality Assurance

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1082 | Quality Assurance | 2 | 1-1-0 |

Objective

- To introduce the concept of SQC
- To understand Design of Experiments concept and ANOVA test
- To learn about the different plots in quality control

Course outcome

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- Understand quality function deployment principles
- Understand concept of Failure mode affect analysis and apply it in product design process.
- Carry out statistical analysis of experiment, ANOVA ratio test and apply advanced DOE method for product testing.
- Understand statistical process control techniques and reliability concepts.
- Understand SIX SIGMA process and lean production concept.
- Prepare Pareto diagrams, cause and effect diagrams, matrix plots and 3-D plots.

### Course content

Module I: Design for Quality (1hr)

Quality Function Deployment, Objectives and functions, Design process, controlling factors in design process.

Module II: Failure Mode Effect Analysis (FMEA) (3hrs)

Basic methods: Refining geometry and layout, general process of product embodiment, embodiment checklists, FMEA method.

Practice 1: Performing a FMEA of a Wooden Chair.

Module III: Design of Experiments (DOE) (4hrs)

Design of Experiments: Basic methods, two factorial experiments, orthogonality, Base design method, higher factorial experiments.

Practice 2: Design of Experiments for comfort conditions in a room using Minitab.

Module IV: Analysis of Variance (ANOVA) (4hrs)

Statistical analysis of experiments, degree of freedom, correlation coefficient, ANOVA test, residual plots.

Practice 3: Performing ANOVA to know the significance of influencing parameters for comfort conditions in a room using Minitab.

Module V: Statistical Process Control (SPC) (2hrs)

Frequency distributions and histograms, Pareto diagrams, Probability distribution, Matrix plots and 3D plots.

Module VI: Reliability (4hrs)

Reliability – Survival and Failure, series and parallel systems, mean time between failure, mean time to repair.

Practice 4: Determining the reliability of series and parallel systems.

Module VII: Design of Six Sigma (4hrs)

Basics of six sigma, project selection for six sigma, six sigma problem solving, six sigma and lean production.

Practice 5: Determining the six sigma limits during machining a cylindrical work piece on CNC lathe.

Text Books:

1. Stastical Quality Control, M. Mahajan, Khanna Publisher.
2. Reliability Engineering, L.S. Srinath, Affiliated East West Press.

Reference Books:

1. Robust Design for Quality Engineering and Six Sigma, Sung H. Park, World Scientific Publisher.

Online Source: (Used in MINI TAB Software)

Course outline Prepared by: Santosh Patro
Date: 5-06-2020
Source of reference: 1. curriculum PG Diploma Tool Design -level-8

## Applied Ergonomics

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1083 | Applied Ergonomics | 2 | 0-1-1 |

**Objective**

- Use the Human Erogonomics software to create an accurate simulation of a human entity and its work environment to ensure a natural operation

**Course outcome**

- Create, manipulate, and analyze how the manikins interact with a product and its environment

### Course content

**Module I: Introduction**

**4(hrs)**

Introduction to Human Factors, Anthropometry and Workplace Design, Biomechanics of Work, Work Physiology, Stress and Workload, Introduction to Virtual Ergonomics Solution

**Module II: Preparing Work Environment** **2 (hrs)**

Workbenches & Tool bars, Setting Options, Exploring the 3D Environment

**Module III: Creating Manikin & Workspace** **2 (hrs)**

Creating Workspace, Setting Manikin Properties, Manipulating Manikin, interacting with workspace, setting manikin constraints, creating catalogs, performing clash analysis

**Module IV: Human Measurements** **2(hrs)**

Workbenches & Tool bars, Human measurements editor, summing up using the editor

**Module V: Human Activity Analysis** **2 (hrs)**

Workbenches & Tool bars, Human Activity Analysis, summing up the analysis

**Module VI: Human Posture Analysis** **2 (hrs)**

Workbenches & Tool bars, Human Posture Analysis, summing up the analysis

**Module VII: Human Task Simulation** **4 (hrs)**

Creating Process Activity, Creating a Manikin Activity, Inserting, resources, motion analysis, Human task simulation, Master project on Ergonomics

*Text Books:*

1. DassaultSystemes Companion Learning Space- Virtual Ergonomics Simulation

*Reference Books:*

## Computer Aided Manufacturing

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1084 | Computer aided manufacturing | 2 | 0-2-0 |

**Objective**

- Create 2-D geometry and 3-D models using various Commands in Master CAM software.
- Create part programs for CNC machining, Contour Concept of cutter compensation using G codes and M codes.
- Create tool path and program for 2-D Lathe operations
- Create tool path and program for 2-D milling, drill tool path, circular milling and facing operation.

**Course outcome**

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- Create 2-D Geometry and 3-D models using various Command in Master CAM software.
- Identify G-Codes and M-codes for programming
- Create 2-D tool path and program for 2-D facing , turning , drilling in lathe.
- Create 2-D tool path and program for circular milling and facing operations.
- Simulation of CNC programs using Master CAM software.

**Course content**

**Module I: Introduction to CAM and Identification of toolbars in Master CAMsoftware (2 hrs)**

Introduction to Computer Aided manufacturing and Master CAM.Identification of sketch toolbars like profile, operations toolbars and using the toolbars to generate the sketch.

**Expt1**: Create a 2D sketch using sketch tool bar and operations tool bar

**Module II- 3-D models using various Commands in Master CAM software (2 Hrs)**

Draw 3-D profiles using various sketch based features like extrude, revolve, Boolean features, rib, slot, groove etc.

**Expt-2**- Create 3 D model using various commands

**Module III : Identification and use of G-code and M code in programming for lathe (4 hrs)**

Functions of G-Code and M-code in lathe machine .Selection and use of G-codes and M codes. Measure tool and work data offset data-X-Z offsets for lathes. Work offsets, lengtl offsets and tool radius for machining center for creating part programming. Cutte compensation.

**Expt-3**- Create work offset for CNC milling machine using Master CAM.
**Expt-4**-Create Work off set for CNC lathe using master CAM

**Module IV: Create 2D tool path for lathe operations (6hrs)**

2D Tool path generation. Concepts of Machining: CNC control basics, & coordinate Systems, Selection of tool, tool parameters,Compensations Program Manager / Creation of 2D tool path for 2D turning , facing ,drilling operations

**Expt-5**- Create 2D tool path for facing and turning operation in lathe.
**Expt-6**- Create 2D tool path for a drilling operation in lathe.
**Expt-7**- Create 2D tool path for a given job in lathe.

**Module V: Create 2D tool path for milling operations (6 hrs)**

Selection of appropriate tool path for milling operation. Proper machine selection, job setting, tool selection. Selection of appropriate machining tolerance, machining parameters like speed, feed and depth of cut. CNC Programming 2-D milling, circular milling operations.

**Expt-8**- Create 2D tool path for facing and profile cutting.
**Expt-9**- Create 2d tool path for circular pocketing.
**Expt-10**-Create 2D tool path for circular countering.

**Module VI: Post processing (3 hrs)**
Post Processing: Generating NC / NC Files / Editing NC Files / Simulation of tool path.

**Expt -11**Create a 2D tool path for a job inCNC millingmachine and simulate it.

**Expt-12**- Create 2D tool path for a job in CNC lathe machine and simulate it.

**Module : VII: Transferring Part programming into CNC machine**

**CNC interface with master CAM ,CNC controls and editing on a machine**

**Expt-12** : Transfer master CAM program to the CNC machine and perform dry run for a job.

**Reference Books:**


1. Groover, M.D and simmers ,E.W, CAD/CAM :Computer aided design and Manufacturing ,Person Education India.
2. Manuals of CAD/CAM software package on CAM module and CNC machine.

## CNC Programming and CNC Machining

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1085 | CNC Programming and CNC Machining | 2 | 0-2-0 |

**Objective**

- Evaluate manufacturing assignment based on critical thinking and problem solving skills. Become a good communicator and effective team member.
- Practice writing complex "G" code programs for CNC turning centers that meet the part specification
- Interpret and demonstrate complex "G" code programs for CNC milling centers that meet the part specification
- Prepare "G: code programs to perform secondary operations including tapping, countersinking, counter boring, and threading.
- Describe and illustrate common problems with tooling and fixtures in CNC programming and machining.

**Course outcome**

.

- Explain applications and advantages of CNC machines and technology
- Demonstrate and explain various CNC control Calculate technological data for CNC machining
- Understand the importance and use of PPE's
- Prepare and understand line program for various profiles Identify and set parameters for various simulators
- Prepare programs,demonstrate, simulate and operate CNC lathe machines for various machining operations
- Prepare programs,demonstrate, simulate and operate CNC milling machines for various machining operations
- Define and explain Modern CNC systems and explain its importance in manufacturing

**Course content**

**Module I: introduction to CNC technology & programming(3hrs)**

Introduction to CNC technology – CNC machines controls. History & development of CNC

technology. Conventional Vs. non-conventional machine tool. Numerical control on CNC machine tools CNC control and CNC Control and types of CNC control Calculation of technological data for CNC machining. CNC clamping system

Expt1: Identification of different parts of CNC lathe including data input

Expt2: Identification of different parts of CNC mill including data input

**Module II: Drawing interpretation(3hrs)**

Drawing interpretation practice, identifying feature from sketch and operation from feature

Expt3: Practice on CNC controller using on-screen simulation for generating different profile

**Module III: CNC programming (4hrs)**

Introduction to CNC programming Introduction and demonstration of line programs CNC programming or lathe & milling machine using iso codes into the CNC simulator. CNC programming for lathe and milling machines using different machining cycles into the CNC simulator. Procedures Associated with part programming, Cutting process parameter selection, Process planning issues and path planning, G & M Codes, Interpolations, Canned Cycles and Subprograms.

Expt4: Writing simple code and test on controller for CNC lathe

Expt5: Writing simple code and test on controller for CNC mill

Expt6: programming canned cycles for simple profile

**Module IV: Program generation for CNC milling and turning(3hrs)**

Tool compensations Exposure for programming and simulator of FANUC, SINUMERIC

Programming exercise.

Expt 7: Machining of programmed exercise on CNC lathe machine.

Expt 8: Machining of programmed exercise on CNC milling machine.

**Module V: CNC Turning (4hrs)**

Plan and optimize programs for CNC turning operations. Calculate parameters like speed feed etc. and set a references for the various operations. Prepare operation and operation sequence for the

lathe operations like turning, grooving etc. Prepare & set CNC lathe operations and test run programmed Execute program and inspect simple geometrical forms / standard parts Use of various PPE's on CNC lathe machine

Expt 9-11: Programming for complex shape cylindrical objects with parameter selection, machining. (at least 3 exercises)

**Module VI: CNC Milling(4hrs)**

Plan and optimize programs for CNC Milling operations. Calculate parameters like speed feed, depth of cut etc. and set a references for the various operations. Various methods of work process like edge finding block center etc. Prepare & set CNC Milling operations and test run programmed. Execute program and inspect simple geometrical forms / standard parts. Use of various PPE's on CNC milling machine

Expt 12-14: Programming for complex shape prismatic objects with parameter selection, machining. (at least 3 exercises)

**Module VII: Modern CNC systems (4hrs)**

Introduction to advanced CNC systems: Computer Aided Part Programming (CAPP), it's application using Solidworks/MasterCAM. comparison of manual part programming and CAPP for a simple component, Automatic Tool Changer, Automatic Pallet Control, Automatic Storage & Retrieval Systems.

Expt 15: comparison of manual part programming and CAPP for a simple component

Text Books:


1. Programming of CNC machines, by Ken Evans
2. CNC Programming Handbook by Peter Smid
3. NC Control by Kundra Rao, Tewari


Reference Books:


3. https://cache.industry.siemens.com/dl/files/554/74475554/att_56792/v1/PGsl_0313_e n_en-US.pdf
4. G codes, M codes Handbook, by Mazak Corporation, sources:
   a. available at Mini Tool Room, Parlakhemundi campus, CUTM

b. https://gist.github.com/anonymous/f14c73a7174bf8a43f0c970817897454

**Source of reference;1. curriculum PG Dploma Tool Desgn and CAD/CAM-level-8**

**Quora.com**

**Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester**

## Design of Tools, Jigs and Fixtures

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1086 | Design of Tools, Jigs and Fixtures | 3 | 2-1-0 |

**Objective**

- To learn basic concepts, functions and design principles of Jigs, Fixtures and Dies
- To know the importance of work piece location & clamping

**Course outcome**

- Able to Understand and Analyse customers need
- Able discuss and finalise product needs
- Conceive the tool design parameters
- Design against standard and parameters
- Test against specifications and standards
- Develop prototype / simulation
- Interpret of output and confirming to specifications
- Communicate with manufacturing line
- Take remedial action if required

### Course content

**Module I: Locating Elements (3hrs)**

Introduction, Jigs (Production Devices), Locating Principle, Locating methods and devices

**Practice 1:** Fabrication of a V – Locator for locating a cylindrical work piece.

**Module II: Clamping Devices (3hrs)**

Introduction, Pneumatics and hydraulic actuation clamping, Analysis of clamping force

**Practice 2:** Estimation of clamping force during clamping of a cylindrical work piece with a V-Locator.

**Module III: Design of Jigs** **(6hrs)**

Introduction, drill bushes, elements of jig, construction, material for jig elements, different types of jigs

**Practice 3:** Designing of a Plate Jig.

**Practice 4:** Designing of a Swinging Leaf Jig.

**Module IV: Drill Jigs** **(3hrs)**

Automatic drill jig, rack and pinion indexing device, Air operated drilling jig component, group jigs and fixtures, chip control, economic justification for jigs and fixtures

**Practice 5:** Study of Automated Jigs.

**Module V: Design of fixtures** **(6hrs**

Introduction, Design principles of fixtures, types of fixture, general principles of boring fixtures, classification of boring fixture, lathe fixture, broaching fixture, Milling fixture, Grinding fixture

**Practice 6:** Designing a Lathe Fixture.

**Practice 7:** Designing a Milling Fixture.

**Module VI: Design of Dies for Sheet Metal Work** **(5hrs)**

Introduction, Types of dies, clearance and tolerance of die opening and punch, force, power, energy in shearing, strip layouts, economical stock utilization

**Practice 8:** Designing a progressive die for making of washer

**Module VII: Design of Drawing and Forming Dies** **(6hrs)**

Theory of drawing, blank development, strain factor, calculation of force, construction of drawing and drawing dies, Modern Metal forming techniques

**Practice 9**: Designing a Forging die for making a gear blank

**Practice 10:** Designing a drawing die for making a circular cross-sectional wire.

## Text Books:

1. Joshi, P H, Jigs & Fixtures, 2010, 3rd Edition, McGraw Hill.

2. Nagpal, G R, Tool Engineering & Design, 2000, Khanna Publishers.

Reference Books:

1. Venkataraman, K, Design of Jigs, Fixtures & Press Tools, 2015, Wiley & Sons

2. Mehta, N K, Metal Cutting and Design of Cutting Tools, Jigs & Fixtures, 2015, McGraw Hill

## Advanced Metrology

| Course Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1087 | Advanced Metrology | 2 | 1-1-0 |

**Course Objective**

- To Make Students Familiar with the Measuring Systems, and the Standard of Measurements. Learns about Basic Measurement Devices.
- Understanding the Basic Measurement Systems in the Real Time Engineering Applications.
- Enables Students to Work in Quality Control and Quality Assurances Divisions Industries.

**Course Outcomes**

- Selecting Suitable Measuring Instruments for Basic and Typical Applications in the Industries.
- Analyze Measurement Requirement.
- Can Choose Transducer & Sensors for Products.

### Course Outline

**Module: I Introduction to Metrology (2Hours)**

Introduction to Metrology; Importance and Need for Measurements and Metrology; Need for Inspection; Precision &Accuracy; Errors in Measurement.

**Practice-1**:Introduction toMetrologylaboratory. Steel Rule, Tape, RightAngle Protractor, Surface Plate

**Module: II Standards of Measurement (4 Hours)**

Verniers and micrometers least count calculation, Uses of Slide callipers, Height Gauge, Micrometer and 3point bore micrometer

**Practice-2**.Vernier Caliper inside, outside, depth measurement and HeightGauge
**Practice-3**.Micrometers, Outside Inside Micrometer , Depth Micrometer
**Practice-4**Three point Bore Micrometer

**Module: III Slip Gauges (2Hours)**

Types of Slip Gauge blocks and uses

**Practice 5**- Calibration of measuringInstruments using slip gauge blocks

**Module: IV Limits, Fits and Tolerances (3 Hours)**

Limits, Fits, Tolerances: Definitions, Types of Fits (Clearance, Transition and Interference) Allowances, Hole and Shaft basis systems with Numerical

**Module: V Angle Measurement (3 Hours)**

Spirit Level, Sine Bar and Bevel Protractor. Least count determination and applications

**Practice-6.**SineBar/Spirit LevelMeasurementofAngles on a Surface plate
**Practice 7**: Angle measurement by Bevel Protractor

**Module: VI Gauge Design (2 Hours)**

Design of Go and NO GO gauges, Ring gauge and Plug Gauge applications

**Practice-8.**Study and use Gauges-Filler, Radius, Thread, Wire, Snap, Go-NoGo gauge

**Module: VII Measurement Machines (6 Hours)**

Tool makers Microscope: Principle and applications, Measuring Machines: Coordinate Measuring Machine, Talysurf, Profile Projector

**Practice-9**.Measurement oftemplate usingProfile Projector
**Practice 10**: Measurement of Profile by Tool makers microscope
**Practice 11**: Measurement of surface roughness using Talysurf

**Text books**:


1. Gupta, I C, A Text Book of ENGINEERING METROLOGY.2016. 8th Edition, Reprint, Dhanpat Rai Publication, New Dehi-110002
2. Narayana, K L, Engineering Metrology.2014. Third Edition, Scitech Publication(India) Privet Limited


**Reference Books:**


1. Mahajan, M, A Text Book of Metrology. 2010. DhanpatRai& Co(P)Ltd,ISBN 13 : 978-817700051

## Thermodynamics

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1088 | Thermodynamics | 3 | 2-1-0 |

**Objective**

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- To know the laws of thermodynamics and conditions for energy transformation
- To get familiar with different thermodynamic properties of pure substances

**Course outcome**

- Utilize the concepts of work and energy to evaluate control volumes as well as closed systems
- Students will be able to do energy analysis and determine efficiency of various thermal devices

**Course content**

**Module I: Basic Concepts of Thermodynamics4(hrs)**

System, Surroundings, Universe, State, Thermodynamic Properties, Process, Types of Process, Reversible and Irreversible process, Quasi-static Process, Cycle, Point and path functions, Thermodynamic Equilibrium, Ideal gas, Ideal gas equation

**Module II: Zeroth Law of Thermodynamics4(hrs)**

Zeroth Law of Thermodynamics, Temperature, Measurement of Temperature, Temperature Measuring Instruments, Relationship between Temperature Scales

**Practice:**

Temperature Measurement by using Thermocouple, Thermistors and Resistance Temperature Detector (RTD)

**Module III: Work Transfer and Heat Transfer 5(hrs)**Work Transfer, Sign Convention of Work, PdV Work for Various Quasistatic Processes, Heat Transfer, Different Modes of Heat Transfer

**Practice:**

- Simulation of Heat Transfer in Conduction, Convection and Radiation using Finite Element Method in Simulia (Plane Wall, Fin, Metal Rod)
- Thermal Stress Analysis of IC Engine Piston using Simulia
- Thermal Analysis of Intake Manifold of Engine using Simulia

**Module IV: First Law of Thermodynamics6(hrs)**

First Law of Thermodynamics Applied to Closed System, Energy, PMM1, Enthalpy,Specific Heat at Constant Volume and Constant Pressure, First Law of Thermodynamics Applied to Open System, Control Volume, Mass Balance and Energy Balance, Nozzle, Diffuser, Turbine, Compressor, Throttling Device, Heat Exchanger

**Practice:**

- Thermal Analysis of Nozzle, Diffuser, Turbine, Compressor, Boilor, Heat exchanger using Simulia

**Module V: Second Law of Thermodynamics5(hrs)**

Kelvin Planks statement,Clausius Statement, PMM2, Working of Heat Engine, Refrigerator and Heat Pump,Carnot Cycle & Carnot Theorem

**Practice:**

- Working of Refrigerator and Heat Engine

**Module VI: Entropy4(hrs)**

Introduction to Entropy, Principle of Increase of Entropy, Clausius Inequality, Change in Entropy in Different Processes

**Practice:**

- Entropy Change of Metal Bar with Temperature Gradient using Simulia

**Module VII: Properties of Pure Substances 5(hrs)**

Introduction to Pure Substance, Phase Change Processes of Pure Substances, T-V, P-V, P-T and H-S Diagram for Steam, Dryness Fraction of Steam, Different Types of Steam. Introduction to

Steam Tables: Specific Volume, Pressure, Temperature, Enthalpy and Entropy

**Practice:**

- Conversion of water to steam
- Determination of properties of steam from Mollier Chart

Text Books:


1. P.K. Nag, "Engineering Thermodynamics", Tata Mcgraw-Hill Publishing Company Limited
2. Y.A Cengel, M. A Boles, "Thermodynamics an Engineering Approach", Tata Mcgraw-Hill Publishing Company Limited


Reference Books:


1. R K Rajput, "A Text Book of Engineering Thermodynamics ", Laxmi Publications
2. Sontag,Borgnakke,VanWylen, " Fundamentals of Thermodynamics", Willey Publisher

## Fluid Mechanics with Finite Volume Method

| Code | Course Title | (Credit) | T-P-PJ |
|---|---|---|---|
| CUTM1089 | Fluid Mechanics with Finite Volume Method | 3 | 2-1-0 |

**Objective**

- To learn To learn fundamentals of computational methods like FVM for solving linear and non-linear partial differential equations related to fluid dynamics
- To emphasizes the basic underlying fluid mechanical principles governing energy transfer in a fluid flow systems with their performances in different field of engineering applications

**Course outcome**

- After completion of the course, the students will able to evaluate finite difference/volume schemes on model problems of computational fluid dynamics.
- Students will learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems

**Course content**

**Module I: Introduction to Finite volume Method (6 hrs)**

Fundamentals of Finite volume methods, different types of finite volume grids, approximation of surface and volume integrals; interpolation methods, Review of governing equations, Classification of governing equations , Staggered and co-located formulation

**Practice:**

1. 2D mapped Mesh for rectangular pipe
2. 2D mapped Meshing for Aerofoil.

**Module II: Grid generation (6 hrs)**

Grid generation, creating, updating and managing meshes, Steady diffusion equation on structured meshes, Unsteady diffusion equation on structured meshes, Linear system solvers, finite volume discretization of steady and unsteady diffusion equation, Finite volume discretization of convection-diffusion problem

**Practice:**

3. 3D structure mesh of Circular Cylinder

4. 3D unstructured mesh with primes layers for Aerofoil

5. 3D coarse/ medium/ fine sweep mesh for pipe

**Module III: Incompressible flow field calculation with finite volume method (5 hrs)**

Navier-stokes equation, Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid solutions of Navier-stokes equation with finite volume method, boundary condition, Reynolds averaged Navier-Stokes equations.

**Module IV: Fluid kinematics (2 hrs)**

Types of flow, Continuity equation (in one, two& three dimension steady state fluid flow analysis with finite volume method, velocity and acceleration fields, streamline, streak line, path line, velocity potential function and stream function, Rotation and vorticity.

**Module V: Fluid Dynamics with Finite volume method (4 hrs)**

Lagrangian and Eulerian Approach, Euler's equation of motion along a stream line for ideal flow, Principle of conservation of energy with finite volume method, Integration of Euler's equation along a stream line, Bernoulli's equation

**Practice:**

6. Fluid Analysis of Bernoulli's equation: Flow in a contracting pipe through CFD simulation

**Module VI: Flow through Pipes ( 5 hrs)**

Reynolds's Experiment, Laws of Laminar and Turbulent Friction, Introduction Turbulence modeling through Finite volume method, Hagen Poiseulle Equation for laminar flow through pipe, Darcy-Weisbach Equation for Turbulent flow through pipe.

**Practice:**

7. Fluid Analysis of Laminar flow in 3D Circular Pipe through CFD simulation

8. CFD Simulation of the Water Flow Passing Through a Converging Pipe.

9. CFD Analysis to determine the frictional losses in the pipe.

**Module VII: Flow Measurement (5 hrs)**

Flow through small orifice meter, Mouthpiece, Velocity Measurement using Pitot tube, Prandtl

tube, Flow measurement in pipes-Flow, Venturi Meter, Flow rate Measurement in channel- Weir and Notches

**Practice:**

10. CFD Analysis of Fluid flow through Orifice meter

11.CFD Analysis of Fluid flow through adjustable channel

12. CFD Analysis of Fluid flow simulation through Venturi Meter

Text Books:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, ninth edition

Reference Books:

2. P.N. Modi & S.N. Seth, Hydraulics & Fluid Mechanics, Rajsons Publications Pvt. Ltd, Twentieth Edition

## Hydraulic Machinery

| Code | Course Title | (Credit) | T-P-PJ |
|---|---|---|---|
| CUTM1090 | Hydraulic Machinery | **2** | **1-1-0** |

**Objective**

- To emphasizes Principle of operation of hydraulic machines and their system design
- To familiarize their huge applications in different industries

**Course outcome**

- After completion of the course, the students will have a strong foundation on the pertinent equations to engineering design of the machines for required applications.
- Students will learn to determine performance characteristics of fluid machinery by using various simulation tools

**Course content**

**Module I: Principle of Operation of Hydraulic Machinery (2 hrs)**

Introduction to hydraulic machines: Classification and operation principle, Euler equation for turbo machines: net head developed by pump and Turbines

**Module II: Radial and Axial flow pumps (8 hrs)**

Velocity triangle of pumps, effect of inlet swirl on velocity triangles, Constructional features of Centrifugal Pump, design aspect, working principle and efficiencies, work done by the impeller, priming, specific speed, NPSH, effect of swirl on the cavitations, working principle and design aspect of gear oil pump.

**Practice:**

1.Flow analysis of fluid of Centrifugal pump through Simulia software

2. Flow analysis of gear oil pump through Simulia software

3.Performance Characteristics of Centrifugal Pump through Virtual lab

**Module III: Positive displacement Pumps (3 hrs)**

Working principle of Reciprocating Pump, discharge, works done and power requirement, ideal indicator diagram, and slip, characteristic H-Q curve of positive displacement pump

**Practice:**

4. Performance Characteristics of Double Acting Reciprocating Pump through Virtual lab.

**Module IV: Hydraulic Turbine: Impulse Turbine (6 hrs)**

Classification, definitions of heads and efficiencies, Pelton Wheel - Construction and working principle, work done and hydraulic efficiency, design aspects.

**Practice:**

5.Simulation of Pelton Turbine through simulia software

6. Performance Characteristics of Pelton Turbine through Virtual lab.

**Module V: Hydraulic Turbine: Reaction Turbine (6 hrs)**

Reaction turbine (Francis, Kaplan) -Components, working principle, work done and efficiency, draft tube, specific speed, cavitations

**Practice:**

7.Performance Characteristics of Francis Turbine Simulia software.

8. Simulation of Kaplan turbine through Virtual lab.

Text Books:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, ninth edition

Reference Books:

1. P.N. Modi & S.N. Seth, Hydraulics & Fluid Mechanics, Rajsons Publications Pvt. Ltd, Twentieth Edition

**Source of reference;**

1. https://nptel.ac.in/course.html
2. www.vlabs.ac.in

## Theory of Machines

| Code | Course Title | (Credit) | T-P-PJ |
|---|---|---|---|
| CUTM1091 | Theory of Machines | 3 | 2-1-0 |

**Objective**

- To cover the kinematics and dynamics of planar single degree freedom mechanisms
- To develop skills for designing and analyzing linkages, cams, gears and other mechanisms
- To address the underlying concepts, methods and application of different machines.

**Course outcome**

- To understand the implication of computed results in kinematics to improve design of a mechanism.
- To Interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc

**Course content**

**Module I: MECHANISMS (03hrs)**

**Theory**

Planar Mechanisms: Kinematic Link, Pair, Chain and Mechanism, Types of Links and Joints, Degree of Freedom, Grashof's Law for four bar Mechanism; Inversions of four bar Mechanism, Single Slider Crank Mechanism and Double Slider Crank Mechanism;

**Practice (01 hrs)**

1. Position Analysis of Grashof and Non-Grashof four bar Mechanism.
2. Position Analysis of Slider Crank Mechanism, Scotch Yoke Mechanism and Elliptical Trammel

**Module II: MOTION ANALYSIS(03hrs)**

**Theory**

Instantaneous Centre of Rotation, Number and Types of Instantaneous Centers, Kennedy Theorem, Relative Velocity Method, Velocities and acceleration in Four Bar and Slider Crank Mechanism.

**Practice (02 hrs)**

3. Instantaneous Center Method to Find Velocity of Various Mechanisms.

4. Velocity Analysis of Grashof and Non-Grashof Four Bar Mechanism

5. Velocity Analysis of Slider Crank Mechanism .

6. Acceleration Analysis of Slider Crank Mechanism

**Module III: POWER TRANSIMISSION SYSTEM(03hrs)**

**Theory**

Classification and Basic Terminology, Fundamental Law of Gearing,

Gear trains: Simple, Compound, Reverted and Epi-Cyclic Gear Trains

Flat Belt, V Belt and Rope Drives and chain drives ,Length of open and cross belt drive, Power Transmitted by Belts and Ropes.

**Practice (02 hrs)**

7.Experiment to calculate sensitiveness of Governor

8.Length of open and cross belt drive

**Module IV: CAMS& GOVERNOR(03hrs)**

**Theory**

Various Types of Cams and Followers; Displacement, Velocity and Acceleration Diagrams for Different Follower Motions; Nomenclature of Cam Profile;

Classification of Governors, Working principle of various type of centrifugal governors, Terminology related to Governor.

**Practice (03 hrs)**

9. Construction of cam profile using Solid works software

10. Cam analysis of a Knife edge and roller follower

11.To calculate sensitiveness of Governor

**Module V: GYROSCOPE (02hrs)**

**Theory**

Gyroscopic Couple, Gyroscopic Effect on Naval Ships and Aeroplanes, Stability of four wheeler

**Practice (01 hrs)**

12. Determine Gyroscopic Couple on Motorized Gyroscope

**Module VI: BALANCING(03hrs)**

**Theory**

Static and Dynamic Balancing, Balancing of Several Masses Revolving in the Same Plane and Different Planes, Balancing of Reciprocating Mass

**Practice (02 hrs)**

13. Balancing of Several Masses Revolving in the Same and Different Planes

14. Balancing of Reciprocating masses by Simulation

**Module VII: VIBRATION (03hrs)**

**Theory**

Basic Concepts and Types of Vibration, Methods of Vibration Analysis, Free Undamped Longitudinal, Transverse and Torsional Vibrations, Damped Free Vibrations, Logarithmic Decrement,Vibration Isolation and Transmissibility;

**Practice (02 hrs)**

15. Determination of Critical or Whirling Speed of Shaft

16. Simple and Compound Pendulum

**Text Books:**

1.S. S. RattanTheory of Machines,. Tata McGraw-Hill Education, 2014

2. Joseph E Shingley Theoryof MachinesandMachinsms oxford publication

**Reference Books:**

2. Singh. S, Theory of Machines, Khanna publishers.

3. Norton R.L, Design of Machinery, McGraw-Hill.

## Heat and Mass Transfer With FDM/FVM

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1092 | Heat and Mass Transfer With FDM/FVM | 3 | 2-1-0 |

**Objective**

- To provide a good exposure for the students to various phenomena associated with fluid flow and different modes of heat & mass transfer

**Course outcome**

- Students will be able to analyze and design various Equipment used in industry using principles of Heat Transfer

### Course content

**Module I: Conduction ( 5 Hrs)**

Fourier's Law of Conduction, General Heat Conduction Equation in Different Coordinate Systems (No Derivation), One Dimensional Steady State Conduction in Plane Wall, Composite Wall, One Dimensional Steady State Conduction in Composite Cylinders and Composite Spheres with Convective Atmosphere. Electrical Analogy, Conduction with Internal Heat Generation.

**Practice**

1. To find the thermal conductivity of a material by the two slabs guarded hot plate method.
2. To find heat transfer through composite wall using Simulia

**Module II: Fins and Transient Conduction (6 Hrs)**

Overall Heat Transfer Coefficients, Critical Thickness of Insulation, Heat Transfer from Extended Surfaces, Effectiveness and Efficiency, Unsteady State Heat Conduction, Lumped Heat Capacity System and Lumped Capacitance Method.

**Practice**

3. To find the thermal resistance of the sample.
4. To find the thermal resistance of the sample using Simulia
5. To find the heat transfer in Transient Heat Conduction using Simulia

**Module III: Convection** **(9 Hrs)**

Hydrodynamic and Thermal Boundary Layer, Principles and Governing Equations, Forced Convection: External Flow over a Flat Plate, Cylinder, Sphere and Non-Circular Ducts, Use of Empirical Relations, Internal Flow Through Pipe, Annular Spaces and Non-Circular Conduits, Natural Convection: Vertical, Horizontal, Inclined Surfaces.

**Practice**

6. To determine the overall heat transfer coefficient at the surface of a given vertical metal cylinder by the natural convection method.
7. To verify Newton's Law of Cooling of different materials and different liquids.
8 . To determine heat transfer coefficient using Simulia
9. To find the temperature variation and heat transfer along cylinder in forced convection using Simulia
10. To find the temperature variation and heat transfer along solid cylinder in natural convection using Simulia

**Module IV: Heat Transfer With Phase Change** **(2 Hrs)**

Film Wise and Drop Wise Condensation, Boiling Heat Transfer, Regimes of Boiling.

**Module V: Heat Exchangers** **(6 Hrs)**

Types of Heat Exchangers, Heat Exchanger Analysis Types of Heat Exchangers, Heat Exchanger Analysis, LMTD, Overall Heat Transfer Coefficient, Heat Exchanger Effectiveness, NTU.

**Practice**

11. Determination of Effectiveness and Efficiency of Parallel Flow and Counter Flow Heat Exchanger.
12. CFD simulation of Heat Exchanger using Simulia

**Module VI: Radiation** **(8 Hrs)**

Electromagnetic Spectrum, Black Body Emission, Emissive Power, Laws of Radiation, Nature of Black and Grey Bodies, Concepts, Radiation Shape Factor, Thermal Resistance and Electrical Analogy, Radiation Heat Transfer Between Two Surfaces, Reradiating Surface, Radiation Shield.

**Practice**

13. To find the emissivity of different material surface.
14. Verification of Stefan Boltzmann’s Law using simulia

**Module VII: Mass Transfer** **(4 Hrs)**

Introduction, Analogy between heat and mass transfer, Mass diffusion, Fick's law of diffusion, boundary conditions, Steady mass diffusion through a wall, Mass convection.

Text Books:

1. Mahesh M. Rathore, Engineering Heat Transfer , Jones & Bartlett Learning, 2011
2. YunusCengel, Heat And Mass Transfer: Fundamentals And Applications, McGraw-Hill Higher Education, 2014

Reference Books:

1. R.C Sachdeva, Fundamentals of Heat and Mass Transfer
2. R.K. Rajput, Heat Transfer, Laxmi Publication

Course outline Prepared by:-Prof.Mukundjee Pandey, Dr.Ashok Mishra, Dr. Vijay
Date: - 25/05/2020
Source of reference:- NPTEL, Coursera, Udemy, MIT Open Course Ware & Virtual Amrita Laboratories Universalizing Education

## Theories of Failure Using Finite Element Analysis

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1062 | Theories of Failure Using Finite Element Analysis | 4 | 2-2-0 |

**Objective**

- To educate the students on basic theories behind mechanics of solids.
- To educate the students on Finite Element Analysis concept applicable to Practical conditions.
- To educate the students on Failure Criterion which will be useful for designing Practical problems.
- To educate the students on using 3D Experience Tools for analysis of various mechanical structures and load transmitting elements.

**Course outcome**

- Students will have knowledge and practical engineering skills in analysis of mechanical strength of structures and load transmission elements and will be able to design them based on input data.
- Students will be able to deploy 3D Experience Platform to develop design solutions.
- Students will be able to apply the Concept of Meshing and Failure Criteria to Practical Problems which will lead Economical and safe in Design Aspect.

**Course content**

**Module I Introduction to Finite Element Analysis (FEA) and 3D Experience Platform - (4(T)+5(P)) (9 Hours)**

**Introduction to FEA:** Need for Studying FEA; Types of Analysis; Discretization of a Structure; Element Shapes, Nodes and Degrees of Freedom; Mesh Refining, Element Aspect Ratio, Use of Symmetry, Principle of Convergence; General Procedure of FEA.

**Material failure Behaviour:** Stress–Strain Diagrams for Ductile and Brittle Materials. Equivalent stresses for varying orientations, Principal stresses, maximum shear stress, Mohr's circles.

**Practice:**

1. Introduction to 3D Experience Platform: About the Apps and their Applications from

Engineering Point of View.

2. Analysis of Steel Bridge – Simulation using 3D Experience Tool.

3. Tensile Test using Simulation 3D Experience Tool.

4. Stress Strain Curve of a Ductile Material (Mild Steel) using Universal Testing Machine

**Module II Mesh Generation and Modeling of Truss Structure (1(T)+ 4(P) (5 Hours)**

Mesh Generation and Methods of Meshing and Types of Meshing. Procedure for selecting the method of meshing and type of meshing.Importance and application of Stiffness Matrix for different types of elements and the procedure for getting the results.

**Practice:**

5. 3D Experience Simulia – Modelling and Meshing of Transmission line tower.

**Module III Stresses and Deflection Criteria: (5(T)+ 4(P) (9 Hours)**

Procedure for Drawing Shear Force and Bending Moment Diagrams, Point of Contra Flexure. **Stresses (No Derivation):** Simple or Pure Bending, Flexure Formula, Section Modulus, Neutral Axis, Determination of Bending Stresses, Shear Stress Distribution for Different Sections. **Deflection :** Equation of Elastic Curve, Direct Integration Method

**Practice:**

6. 3D Experience Simulia – Modelling and Finite Element Analysis of Framed Structure subjected Earthquake Loads.

**Module IV: Theories of Failure: (2(T)+ 4(P) (6 Hours)**

**Theories of Failure:** Failure Under Biaxial Loading, Rankine's Theory, Guest's or Tresca's Theory, Von Mises Theory, Graphical Representation of Failure, Safety Factors, Prevention of Failure in Design Stage, Diagnosis of Failure In Post-Manufacturing Stage.

**Practice:**

7. 3D Experience Simulia: Bicycle Frame Structural Analysis

**Module V: Torsion: (3(T)+ 4(P) (7 Hours)**

**Torsion:** Torsion Equation, Design of Shafts, Power Transmitted by Shafts, Composite Shafts, Combined Bending and Torsion, Closed-Coiled Helical Springs, Spring Connected in Series and

Parallel.

**Dynamic Analysis:** Fundamentals of Vibration; Evaluation of Natural Frequencies and Mode Shapes (Eigen values and Eigenvectors); Non-linear Analysis, Fatigue Analysis. Structures Subjected to Blast Loads.

**Practice:**

8. Simulation: Static and Dynamic Analysis of Shaft

**Module VI Pressure Vessels (1(T)+ 2(P) (3 Hours)**

Longitudinal and Hoop Stress in Thin-walled Pressure Vessels Subjected to Internal Pressure.

**Practice:**

9. Simulation: Crack Analysis of Thin walled Pressure Vessels.

**Module VII Fatigue and Fracture: (3(T)+ 4(P) (7 Hours)**

**Fatigue:** Failure Under Cyclic Loading, Endurance Limit. S-N Curve, Stress Concentration, Goodman and Soderberg Criteria.

**Fracture:** Types of Failure, Brittle and Ductile Fracture, Basic Modes of Fracture. Griffith's Analysis, Crack Growth and Stress Intensity Factor.

10. Fatigue Analysis of Crankshaft of Two-Wheeler

Text Books:


1. Strength of Materials, S.S. Rattan, Tata Mc-Graw Hill Publication.
2. Advanced Mechanics of Materials, A.P. Boresi and R.J. Schmidt, Willey India


Reference Books:


1. Elements of Fracture mechanics, Prashant Kumar, McGraw Hill Education (India)
2. Engineering Mechanics of Solids, Egor P. Popov, Pearson publication
3. Strength of Materials, R.K.Bansal, Laxmi Publications.

## Optimization Techniques

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1093 | Optimization Techniques | 2 | 0-2-0 |

**Objective**

- To Create an Engineering design methodology using a mathematical formulation of a design problem to support selection of the optimal design among alternatives

**Course outcome**

- Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems
- Ability to go in research by applying optimization techniques in problems of Engineering and Technology
- Ability to solve the mathematical results and numerical techniques of optimization theory to concrete Engineering problems by using computer software

**Course content**

**Module-I:** Linear Programming: Graphical Method, Simplex method, Penalty Method

**Module-II:** Transportation Models, Assignment Models, Sequencing and Scheduling Models by Johnson's Algorithm

References


- Harvey M. Wagner, *Principles of Operations Research*, Englewood Cliffs, Prentice-Hall, 1969
- S D Sharma and Himansu Sharma, Operations Research: Theory, Methods and Applications, 15 Edition, KedarnathRamnath& Co

External Links:
https://www.informs.org/Resource-Center/INFORMS-Student-Union/Consider-an-Analytics-OR-Career
https://www.informs.org/
https://en.wikipedia.org/wiki/Operations_research

Google and YouTube

**Database Management Systems**

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1059 | Database Management Systems | 3 | 2-1-0 |

**Objective**

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database Modeling,relational,hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential Peoperties of DBMS concepts such as: database security,integrity, concurrency
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

**Course outcome**

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model,relational database design, relational algebra and SQL
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization
- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing

**Course content**

**Module-1**: **DBMS Concepts [5 Hrs]**
Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology.

**Module-2: Data Modeling [5Hrs]**
Basic concepts- Types of data models- Conceptual, physical and logical database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modeling symbols.

Entity and entity sets- Relations and relationship sets- E-R Diagrams- Reducing E-R Diagrams into tables.

**Practice**

Assume we have the following application that models soccer teams, the games they play, and the
players in each team. In the design, we want to capture the following:

• We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.

• Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.

• Teams play matches, in each match there is a host team and a guest team. The match takes place
in the stadium of the host team.

• For each match we need to keep track of the following:

• The date on which the game is played

• The final result of the match

• The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.

• During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.

• Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.

Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design (use the back of the page if needed). Make sure cardinalities and primary keys are clear.

**Module-3: Relational DBMS Model [5 Hrs]**

Basic concepts, Attributes and domains- Intention and extensions of a relation- concept of integrity and referential constraints- Relational Query Languages (Relational algebra and relational calculus (Tuple and domain relational calculus).

**Module-4: Relational Database Design [6 Hrs]**

Notion of normalized relations- Normalization using Functional Dependency- First Normal form- Second Normal Form- Third Normal form- BCNF.

**Practice**

Perform NF on the given table

CLICK HERE FOR TABLE

**Module-5: SQL [6 Hrs]**
Structure of a SQL query- DDL and DML, TCL- SQL queries and sub queries- Tables, views and indexes.

**Practice**
To study DDL-create and DML-insert commands.

(i) Create tables according to the following definition.

CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5) ,CNAME VARCHAR2(18) , BNAME VARCHAR2(18) , AMOUNT NUMBER(8,2) ,ADATE DATE);
CREATE TABLE BRANCH(BNAME VARCHAR2(18),CITY VARCHAR2(18)); CREATE TABLE CUSTOMERS(CNAME VARCHAR2(19) ,CITY VARCHAR2(18));
CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2));
(ii) Insert the data as shown below.

DEPOSIT
CLICK HERE FOR TABLE
BRANCH
CLICK HERE FOR TABLE
CUSTOMERS
CLICK HERE FOR TABLE
BORROW
CLICK HERE FOR TABLE
(1) Describe deposit, branch.
(2) Describe borrow, customers.
(3) List all data from table DEPOSIT.
(4) List all data from table BORROW.
(5) List all data from table CUSTOMERS.
(6) List all data from table BRANCH.
(7) Give account no and amount of depositors.
(8) Give name of depositors having amount greater than 4000.
(9) Give name of customers who opened account after date '1-12-96'.

**Module-6:Aggregate functions [4 Hrs]**
Set Operations, predicates and joins, Set Membership- Tuple variables- Set comparison- Database modifications using SQL.

**Practice**
Create the below given table and insert the data accordingly.

Create Table Job (job_id, job_title, min_sal, max_sal)

COLUMN NAME DATA TYPE
job_id Varchar2(15)
job_title Varchar2(30)
min_sal Number(7,2)
max_sal Number(7,2)
Create table Employee (emp_no, emp_name, emp_sal, emp_comm, dept_no)

COLUMN NAME DATA TYPE
emp_no Number(3)
emp_name Varchar2(30)
emp_sal Number(8,2)
emp_comm Number(6,1)
dept_no Number(3)
Create table deposit(a_no,cname,bname,amount,a_date).

COLUMN NAME DATA TYPE
a_no Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Number(7,2)
a_date Date

Create table borrow(loanno,cname,bname,amount).

COLUMN NAME DATA TYPE
loanno Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Varchar2(7,2)

Insert following values in the table Employee.

emp_n emp_name emp_sal emp_comm dept _no
101 Smith 800 20
102 Snehal 1600 300 25
103 Adama 1100 0 20
104 Aman 3000 15
105 Anita 5000 50,000 10
106 Sneha 2450 24,500 10
107 Anamika 2975 30
Insert following values in the table job.

CLICK HERE FOR TABLE
Insert following values in the table deposit.

CLICK HERE FOR TABLE

Perform following queries

(1) Retrieve all data from employee, jobs and deposit.

(2) Give details of account no. and deposited rupees of customers having account opened between dates 01-01-06 and 25-07-06.

(3) Display all jobs with minimum salary is greater than 4000.

(4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.

(5) Display employee no,name and department details of those employee whose department lies in(10,20)

To study various options of LIKE predicate

(1) Display all employee whose name start with 'A' and third character is ' 'a'.

(2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'.

(3) Display the non-null values of employees and also employee name second character should be 'n' and string should be 5 character long.

(4) Display the null values of employee and also employee name's third character should be 'a'.

(5) What will be output if you are giving LIKE predicate as '%_%' ESCAPE '\'

To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.

(1) List total deposit from deposit.

(2) List total loan from karolbagh branch

(3) Give maximum loan from branch vrce.

(4) Count total number of customers

(5) Count total number of customer's cities.

(6) Create table supplier from employee with all the columns.

(7) Create table sup1 from employee with first two columns.

(8) Create table sup2 from employee with no data

(9) Insert the data into sup2 from employee whose second character should be 'n' and string should be 5 characters long in employee name field.

(10) Delete all the rows from sup1.

(11) Delete the detail of supplier whose sup_no is 103.

(12) Rename the table sup2.

(13) Destroy table sup1 with all the data.

(14) Update the value dept_no to 10 where second character of emp. name is 'm'.

(15) Update the value of employee name whose employee number is 103.

To study Single-row functions.

(1) Write a query to display the current date. Label the column Date

(2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary
(3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase
(4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
(5) Write a query that produces the following for each employee:
earns monthly
(6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.
(7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.
(8) Write a query to calculate the annual compensation of all employees (sal+comm.).

Displaying data from Multiple Tables (join)

(1) Give details of customers ANIL.
(2) Give name of customer who are borrowers and depositors and having living city nagpur
(3) Give city as their city name of customers having same living branch.
(4) Write a query to display the last name, department number, and department name for all employees.
(5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output
(6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.
(7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.
(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

**Module-7: Transaction Management [8 Hrs]**
Subqueries,Manupulating Data,Transaction management and Concurrency control
**Practice**
To apply the concept of Aggregating Data using Group functions.

(1) List total deposit of customer having account date after 1-jan-96.
(2) List total deposit of customers living in city Nagpur.
(3) List maximum deposit of customers living in bombay.
(4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
(5) Write a query that displays the difference between the highest and lowest salaries. Label the

column DIFFERENCE.
(6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998
(7) Find the average salaries for each department without displaying the respective department numbers.
(8) Write a query to display the total salary being paid to each job title, within each department.
(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.
(10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.

(11) List the branches having sum of deposit more than 5000 and located in city bombay.

To solve queries using the concept of sub query.

(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT
(2) Give name of customers who are depositors having same branch city of mr. sunil.
(3) Give deposit details and loan details of customer in same city where pramod is living.
(4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.
(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000
(6) Display the last name and salary of every employee who reports to ford.
(7) Display the department number, name, and job for every employee in the Accounting department.
(8) List the name of branch having highest number of depositors.
(9) Give the name of cities where in which the maximum numbers of branches are located.
(10) Give name of customers living in same city where maximum depositors are located.

Manipulating Data

(1) Give 10% interest to all depositors.
(2) Give 10% interest to all depositors having branch vrce
(3) Give 10% interest to all depositors living in n
agpur and having branch city bombay.
(4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844'current department number.
(5) Transfer 10 Rs from account of anil to sunil if both are having same branch.
(6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.
(7) Delete depositors of branches having number of customers between 1 to 3.
(8) Delete deposit of vijay.
(9) Delete borrower of branches having average loan less than 1000.

**To apply the concept of security and privileges.**

**To study Transaction control commands**

VIRTUAL LAB

**TEXT BOOKS**

Database Management Systems: Raghu Ramakrishnan

ORACLE PL/SQL Programming – Scott Urman BPB Publications.

**REFERENCES**

Database Systems Concepts – Henry F Korth, Abraham Silberschatz.

Database Management Systems – Alexis Leon, Mathews Leon – Leon, Vikas Publications

## Programming in Java(Same as Java Technologies)

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1058 | Programming in Java(Same as Java Technologies) | 3 | 2-1-0 |

**Objective**

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development
- Have the ability to write a computer program to solve specified problems
- Have the ability to write a computer program to solve specified problems
- Be able to use the Java SDK environment to create, debug and run simple Java programs

**Course outcome**

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs
- Read and make elementary modifications to Java programs that solve real-world problems
- Identify and fix defects the common safety issues in code
- Document a Java program using Javadoc
- Use a version control system to track source code in a project
- Qualify confidently any interview process where Java is the requirement

**Course content**

**Module I: Introduction to Java (8 hrs)**

Features and Installation, Java Programming Basics, Decision Making and Looping, Class and Object, Inheritance
Practice 1 (1 Hr)
Practice 2 (1 Hr)

**Module II: Package and Safe Code (5 Hr)**

Interfaces, Packages and Access Protection, Exception Handling (Fault Tolerant Programming)

Practice 3 (1 Hr)

**Module III: Collection and Threads (5 Hr)**

ArrayList, Vector, Set, Map, Multi-threaded Programming, Synchronization

Practice 4 (1 Hr)

**Module IV: Language and Utility Packages (5 Hr)**

String Handling, Wrappers, Runtime Memory Management, Cloning, Calendar, Date and Time Facilities, Scanner, Internationalization

Practice 5 (1 Hr)

Practice 6 (1 Hr)

**Module V: Input/ Output and Applets (5 Hr)**

Byte and Character Stream I/O, Persistence, Applet: Architecture, Skeleton, and Implementation

Practice 7 (1 Hr)

Practice 8 (1 Hr)

**Module VI: GUI Programming (5 Hr)**

AWT: Container, Components, Layout Managers, Event Handling

Practice 9 (1 Hr)

Practice 10 (1 Hr)

**Module VII: Networking and Advanced (5 Hr)**

Networking Fundamental, Client-Server Communication, Remote Method Invocation (RMI), Java Virtual Machine (JVM) Tuning, Java Profiler

Practice 11 (1 Hr)

Practice 12 (1 Hr)

*Text Book(s):*

1. Java The Complete Reference, Fifth Edition, C25 Herbert Schildt, McGraw-Hills

*Reference Book(s):*

1. Murach's Java Programming, 5th Edition, Joel Murach, Mike Murach & Associates, 2011, ISBN-78-1-943872-07-7
2. Introduction to Java Programming, Comprehensive, 10th ed., Y. Daniel Liang, 2014. ISBN-10: 0133813460, ISBN-13: 9780133813463

https://nqr.gov.in/qualification-title?nid=3002
https://www.cdac.in/index.aspx?id=DAC&courseid=0#
https://canvas.harvard.edu/courses/63117/assignments/syllabus
https://canvas.harvard.edu/courses/69911/assignments/syllabus
https://xid.harvard.edu/xid-apps/submitAccountForm.do

*YouTube Resources:* freeCodeCamp.org
Codearchery
Edureka
free project
Jenkov

Online Source(s):

1. https://docs.oracle.com/javase/tutorial/java/index.html

2. https://www.programiz.com/java-programming

3. https://marcus-biel.com/

Software/Tool(s): Java 8, Eclipse IDE

Online Compiler: https://ideone.com/

Online Coding Practice: https://www.hackerrank.com/

List of Practices:

**Practice 1 (Module-I)**

Program-1:

Write a program that computes the standard deviation of a set of floating point numbers that the user enters. First the user says how many numbers N are to follow. Then the program asks for and reads in

each floating point number. Finally it writes out the standard deviation. The standard deviation of a set of numbers Xi is:

SD = Math.sqrt( avgSquare - avg2 )

Here, avg is the average of the N numbers, and avg2 is its square.

avgSquare is the average of Xi * Xi. In other words, this is the average of the squared value of each floating point number.

For example, if N = 4, say the numbers were:

Xi Xi * Xi

2.0 4.0

3.0 9.0

1.0 1.0

2.0 4.0

sum 8.0 18.0

Now:

avg = 8.0/4 = 2.0

avg2 = 4.0

avgSquare = 18.0/4 = 4.5

SD = Math.sqrt( 4.5 - 4.0 ) = Math.sqrt( .5 ) = 0.7071067812

To do this you will need to do several things inside the loop body for each floating point value as it comes in: add it to a sum, square it and add it to a sum of squares. Then after the loop is finished apply the formula.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 2 (Module-I)**

Program-1:

Better encapsulation of the Goods class would call making instance variables private and using getter and setter methods to access them. A further refinement would be to make the class abstract and to define additional child classes. Here is a revised Goods class:

```
public abstract class GoodsSGA
{
private String description;
private double price;
private int quantity;
public GoodsSGA( String des, double pr, int quant )
{description = des;
price = pr;
quantity = quant;}
double getPrice()
{return price;}
void setPrice( double newPrice)
{price = newPrice;}
int getQuantity()
{return quantity;}
void setQuantity ( int newQuantity )
{quantity = newQuantity;}
public String toString()
{return "item: " + description + " quantity: " + quantity + " price: " + price ;}
```

Revise the source code for the classes Food, Toy, and Book. (Perhaps call the revised classes FoodSG,

ToySG, and BookSG.) create a new class ToiletrySG for things like bubble bath. Create a new testing class, StoreSG to test your revised classes.

Note: the child classes will need to use the getter and setter methods to access the instance variables that are declared as private in GoodsSG.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 3 (Module-II)**

Program-1:

User-Friendly Division Practice:

Put in a loop so that the user is repeatedly asked for the numerator and the divisor. For each set of data, the program prints out the result, or an informative error message if there is a problem (division by zero or poor input data).

The program continues looping, even if there is a problem Exit the loop when data entered for the numerator start with characters "q" or "Q". Don't print out an error message in this case.

Don't ask for the divisor if the user just asked to quit.

Here is sample output from one run:

Enter the numerator: 12

Enter the divisor: 4

12 / 4 is 3

Enter the numerator: 12

Enter the divisor : 0

You can't divide 12 by 0

Enter the numerator: glarch

You entered bad data.

Please try again.

Enter the numerator: quit

You will need to use the method charAt() from the String class.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 4 (Module-III)**

Program-1:

In mathematics, several operations are defined on sets. The union of two sets A and B is a set that contains all the elements that are in A together with all the elements that are in B. The intersection of A and B is the set that contains elements that are in both A and B. The difference of A and B is the set that contains all the elements of A except for those elements that are also in B.

Suppose that A and B are variables of type set in Java. The mathematical operations on A and B can be computed using methods from the Set interface. In particular:

A.addAll(B) computes the union of A and B; A.retainAll(B) computes the intersection of A and B; and A.removeAll(B) computes the difference of A and B. (These operations change the contents of the set A, while the mathematical operations create a new set without changing A, but that difference is not relevant to this exercise.)

For this exercise, you should write a program that can be used as a "set calculator" for simple operations on sets of non-negative integers. (Negative integers are not allowed.) A set of such integers will be represented as a list of integers, separated by commas and, optionally, spaces and enclosed in square brackets. For example: [1,2,3] or [17, 42, 9, 53,108]. The characters +, *, and - will be used for the union, intersection, and difference operations. The user of the program will type in lines of input containing two sets, separated by an operator. The program should perform the operation and print the resulting set.

Here are some examples:

Input Output

---------- ----------

[1, 2, 3] + [3, 5, 7] [1, 2, 3, 5, 7]

[10,9,8,7] * [2,4,6,8] [8]

[ 5, 10, 15, 20 ] - [ 0, 10, 20 ] [5, 15]

To represent sets of non-negative integers, use sets of type TreeSet<Integer>. Read the user's input, create two TreeSets, and use the appropriate TreeSet method to perform the requested operation on the two sets. Your program should be able to read and process any number of lines of input. If a line contains a syntax error, your program should not crash. It should report the error and move on to the next line of input. (Note: To print out a Set, A, of Integers, you can just say System.out.println(A). We've chosen the syntax for sets to be the same as that used by the system for outputting a set.)

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 5 (Module-IV)**

Program-1:

Password Checker:

Write a program that repeatedly asks the user for a proposed password until the user enters an acceptable password. When the user enters an acceptable password, the program writes a message and exits.

Acceptable passwords:

Are at least 7 characters long.

Contain both upper and lower case alphabetic characters. Contain at least 1 digit. The logic of this program can be quite tricky. Hint: use toUpperCase(), toLowerCase, and equals(). You will also need nested ifs.

Here is a run of the program:

Enter your password:

snowflake

That password is not acceptable.

Enter your password:

SnowFlake

That password is not acceptable.

Enter your password:

snowflake47

That password is not acceptable.

Enter your password:

Snowflake47

Acceptable password.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 6 (Module-IV)**

Program-1:

Secret Code:

A text message has been encoded by replacing each character of the message with an integer. Each integer is an index into a key-phrase that contains all the lower case letters of the alphabet as well as the space character. The key-phrase may contain the same character in several locations. The encoded text is series of integers, like this:

35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

To decode the message, look up each integer in the key-phrase and output the corresponding character.

For example, say that the key-phrase is this (the index of each character has been written above it):

11111111112222222222333333333344444444455

01234567890123456789012345678901234567890123456789012345678901

six perfect quality black jewels amazed the governor

using each integer from the encoded text as an index into the phrase results in the decoded message:

attack the bridge at dawn

Write a program that decodes a secret message contained in a text file. The first line of the text file contains the key-phrase. Then the file contains a sequence of integers, each of which indexes the key-phrase. Find the character corresponding to each integer and output the secret message. Note if a character character such as 'e' occurs several places in the key-phrase it may be encoded as different integers in different parts of the secret message.

(The recipient of the secret message gets only the file of integers and must put the key-phrase at the top of the file.) For example, here is the contents of a secret message file ready for the program:

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35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

Here is a sample run of the program:

C:\> java Decode < secretFile.txt

attack the bridge at dawn

You will need the charAt() method of String.

Here is another secret message file, with key-phrase inserted, that you can use to test your program:

six perfect quality black jewels amazed the governor

31 16 2 3 4 42 48 7 27 9 10 43 12 13 35 15 1 40 18 3

20 15 33 23 24 32 26 29 28 27 21 31 25 14 34 14 36

42 38 19 40 41 27 3 44 50 46 42 48 49 50 6

Program-2 and Program-3:

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**Practice 7 (Module-V)**

Program-1:

Stop Word Remover:

Write a program that reads in a file of text, perhaps the text of a novel. The program copies the same text to an output file, except that all the useless words such as "the", "a", and "an" are removed. (Decide on what other words you with to remove. The list of words removed is called a stop list.) Do this by reading the text file token by token using hasNext() and next(), but only writing out tokens not on the stop list. Prompt the user for the names of the input and output files.

Fairly Easy: The output file will have only N tokens per line. Do this by counting tokens as you output them. N will be something like 10 or 12.

Improved Program: Preserve the line structure of the input file. Do this by reading each line using nextLine() and then creating a new Scanner for that line. (Look at the on-line documentation for Scanner.) With each line's Scanner, use hasNext() and next() to scan through its tokens.

Harder: Write out no more than N characters per line. N will be something like 50. Do this by keeping count of the number of characters written out per line. The length() method of String will be useful. If X characters has already been written to the current line, and if X plus the length of the current token exceeds N, then start a new line.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 8 (Module-V)**

Program-1:

E-Mail Address Extractor:

Write a program that scans a text file for possible e-mail addresses. Addresses look like this:

someone@somewhere.net

Read tokens from the input file one by one using hasNext() and next(). With the default delimiters of Scanner, an entire e-mail address will be returned as one token. Examine each token using the indexOf() method of String. If a token contains an at sign @ followed some characters later by a period, regard it as a possible e-mail address and write it to the output file.

Programs such as this scan through web pages looking for e-mail addresses that become the targets of spam. Because of this, many web pages contain disguised e-mail addresses that can't easily be automatically extracted.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 9 (Module-VI)**

Program-1:

User-friendly Fat Calculator, with Advice:

Further modify the calories from fat calculator so that it includes another TextField that will be set with the text "Too many fat calories" if the percentage of calories from fat is equal or greater than 30 percent, or to "Healthy amount of fat" if the percentage is less than that.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 10 (Module-VI)**

Program-1:

Three Button Monte:

Write a program to implement a game:

There are three buttons in the frame. Two of the buttons cause the program to quit using System.exit(0); the remaining button changes the frame to green (a win!) The winning button is different each time the game is played.

The easy way to do this (although it seems unfair to the user) treats each button the same way. The actionPerformed() method does not check which button was clicked. When any button is clicked, the method picks a random integer from 0 to 2 and performs the "winning" action if the integer happens to be 0. Otherwise, it performs the "losing" action. To the user, it seems like there is a "winning" button and two "losing" buttons. But, in fact, it does not matter which button was clicked.

This is similar to some electronic gambling devices in casinos, where it appears to the user that there are "winning moves" and "losing moves" but in fact the machine actually ignores what the user has done and just declares a "win" every now and then, according to predetermined odds.

You will need the Random class:

```
Random randNum = new Random(); // create a Random number object
. . .
int someInt = randNum.nextInt(3); // someInt gets a number from 0 to 2
```

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

**Practice 11 (Module-VII)**

Content Delivery with Networking:

Write a Client-Server program where the client queries with a name of file and the server delivers the content of requested files to the client over the network.

(Improve the program by making the server multi-threaded)

**Practice 12 (Module-VII)**

Greet the user with Remote Method Invocation:

Write a program using RMI, where the user invokes a method on remote object with username as parameter and receives a greeting message based on time of the day along with username.

## Projects

However, not limited to:

1. Chat application
2. Text Editor application
3. GUI based Scientific Calculator
4. Paint application
5. Slam book

(*PROJECT REVIEWS WILL COMMENCE BEYOND CLASS HOURS)

**Monitoring:**
Credit will be received only on making an honest effort. It is expected that students will finish watching all lecture video and complete all challenge problems by the end of each lecture week.
Borrowing code from other sources is allowed only with proper attribution and credit given to the original author(s).

**List of Common Programs to solve using Java:**

*1.Program to calculate area of a triangle*

*2.Program to solve quadratic equation*

*3.Program to swap two zariables (with and without using third variable)*

*4.Program to generate random numbers in various ways*

*5.Program to convert miles to kilometers and vice-versa*

*6.Program to convert celsius to fahrenheit and vice-versa*

*7.Program to check if a number is odd or even*

*8.Program to check if input year is leap year*

*9.Program to test primality*

*10.Program to print all prime numbers in an interval using "Sieve of Eratosthenes"*

*11.Program to generate factorial of all elements in an array*

*12.Program to display the multiplication table up to 20*

*13.Program to print the fibonacci sequence*

*14.*
*Program to check armstrong number, perfect number, Harshad number*

*15.Program to generate armstrong numbers in an Interval*

*16.Program to find the sum of Harshad numbers in an interval*

*17.Program to display powers of two Using lambda*

*18.Program to perform conversions among decimal to binary, octal and hexadecimal*

*19.Program to display ASCII table*

*20.Program to find HCF/GCD and LCM*

*21.Program to find factors of given natural number*

*22.Program to make a simple calculator*

*23.Program to shuffle deck of cards*

*24.Program to generate fibonacci sequence using recursion*

*25.Program to find sum of natural numbers using recursion*

*26.Program to find factorial of number using recursion*

*27.Program to convert decimal to binary using recursion*

*28.Program to add two matrices*

*29.Program to obtain transpose of a matrix*

*30.Program to multiply two matrices*

*31.Program to check if a string is palindrome*

*32.Program to remove punctuations from a string*

*33.Program to sort words lexicographically*

*34.Program to illustrate different set operations*

*35.Program to count frequency of each vowel in a string*

*36.Program to find hash value of a file*

**This course on courseware:** http://courseware.cutm.ac.in/courses/java-technologies/

**Database Management Systems**

| Code | Course Title | Credit | T-P-PJ |
|---|---|---|---|
| CUTM1059 | Database Management Systems | 3 | 2-1-0 |

**Objective**

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database Modeling,relational,hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential Peoperties of DBMS concepts such as: database security,integrity, concurrency
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

**Course outcome**

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model,relational database design, relational algebra and SQL
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization
- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing

**Course content**

**Module-1**: **DBMS Concepts [5 Hrs]**

Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology.

**Module-2: Data Modeling [5Hrs]**

Basic concepts- Types of data models- Conceptual, physical and logical database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modeling symbols. Entity and entity sets- Relations and relationship sets- E-R Diagrams- Reducing E-R Diagrams into tables.

**Practice**

Assume we have the following application that models soccer teams, the games they play, and

the
players in each team. In the design, we want to capture the following:
• We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
• Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
• Teams play matches, in each match there is a host team and a guest team. The match takes place
in the stadium of the host team.
• For each match we need to keep track of the following:
• The date on which the game is played
• The final result of the match
• The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
• During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
• Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.
Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design (use the back of the page if needed). Make sure cardinalities and primary keys are clear.

**Module-3: Relational DBMS Model [5 Hrs]**

Basic concepts, Attributes and domains- Intention and extensions of a relation- concept of integrity and referential constraints- Relational Query Languages (Relational algebra and relational calculus (Tuple and domain relational calculus).

**Module-4: Relational Database Design [6 Hrs]**

Notion of normalized relations- Normalization using Functional Dependency- First Normal form- Second Normal Form- Third Normal form- BCNF.

**Practice**

Perform NF on the given table

CLICK HERE FOR TABLE

**Module-5: SQL [6 Hrs]**

Structure of a SQL query- DDL and DML, TCL- SQL queries and sub queries- Tables, views and indexes.

**Practice**

To study DDL-create and DML-insert commands.
(i) Create tables according to the following definition.
CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5) ,CNAME VARCHAR2(18) , BNAME VARCHAR2(18) , AMOUNT NUMBER(8,2) ,ADATE DATE);
CREATE TABLE BRANCH(BNAME VARCHAR2(18),CITY VARCHAR2(18)); CREATE TABLE CUSTOMERS(CNAME VARCHAR2(19) ,CITY VARCHAR2(18));
CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME

VARCHAR2(18), AMOUNT NUMBER (8,2));
(ii) Insert the data as shown below.
DEPOSIT
CLICK HERE FOR TABLE
BRANCH
CLICK HERE FOR TABLE
CUSTOMERS
CLICK HERE FOR TABLE
BORROW
CLICK HERE FOR TABLE
(1) Describe deposit, branch.
(2) Describe borrow, customers.
(3) List all data from table DEPOSIT.
(4) List all data from table BORROW.
(5) List all data from table CUSTOMERS.
(6) List all data from table BRANCH.
(7) Give account no and amount of depositors.
(8) Give name of depositors having amount greater than 4000.
(9) Give name of customers who opened account after date '1-12-96'.

**Module-6:Aggregate functions [4 Hrs]**

Set Operations, predicates and joins, Set Membership- Tuple variables- Set comparison- Database modifications using SQL.

**Practice**

Create the below given table and insert the data accordingly.
Create Table Job (job_id, job_title, min_sal, max_sal)
COLUMN NAME DATA TYPE
job_id Varchar2(15)
job_title Varchar2(30)
min_sal Number(7,2)
max_sal Number(7,2)
Create table Employee (emp_no, emp_name, emp_sal, emp_comm, dept_no)
COLUMN NAME DATA TYPE
emp_no Number(3)
emp_name Varchar2(30)
emp_sal Number(8,2)
emp_comm Number(6,1)
dept_no Number(3)
Create table deposit(a_no,cname,bname,amount,a_date).
COLUMN NAME DATA TYPE
a_no Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Number(7,2)
a_date Date

Create table borrow(loanno,cname,bname,amount).
COLUMN NAME DATA TYPE
loanno Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Varchar2(7,2)
Insert following values in the table Employee.
emp_n emp_name emp_sal emp_comm dept _no
101 Smith 800 20
102 Snehal 1600 300 25
103 Adama 1100 0 20
104 Aman 3000 15
105 Anita 5000 50,000 10
106 Sneha 2450 24,500 10
107 Anamika 2975 30
Insert following values in the table job.
CLICK HERE FOR TABLE
Insert following values in the table deposit.
CLICK HERE FOR TABLE
Perform following queries
(1) Retrieve all data from employee, jobs and deposit.
(2) Give details of account no. and deposited rupees of customers having account opened between dates 01-01-06 and 25-07-06.
(3) Display all jobs with minimum salary is greater than 4000.
(4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.
(5) Display employee no,name and department details of those employee whose department lies in(10,20)
To study various options of LIKE predicate
(1) Display all employee whose name start with 'A' and third character is ' 'a'.
(2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'.
(3) Display the non-null values of employees and also employee name second character should be 'n' and string should be 5 character long.
(4) Display the null values of employee and also employee name's third character should be 'a'.
(5) What will be output if you are giving LIKE predicate as '%_%' ESCAPE '\'
To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.
(1) List total deposit from deposit.
(2) List total loan from karolbagh branch
(3) Give maximum loan from branch vrce.
(4) Count total number of customers
(5) Count total number of customer's cities.
(6) Create table supplier from employee with all the columns.

(7) Create table sup1 from employee with first two columns.
(8) Create table sup2 from employee with no data
(9) Insert the data into sup2 from employee whose second character should be 'n' and string should be 5 characters long in employee name field.
(10) Delete all the rows from sup1.
(11) Delete the detail of supplier whose sup_no is 103.
(12) Rename the table sup2.
(13) Destroy table sup1 with all the data.
(14) Update the value dept_no to 10 where second character of emp. name is 'm'.
(15) Update the value of employee name whose employee number is 103.
To study Single-row functions.
(1) Write a query to display the current date. Label the column Date
(2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary
(3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase
(4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
(5) Write a query that produces the following for each employee:
earns monthly
(6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.
(7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.
(8) Write a query to calculate the annual compensation of all employees (sal+comm.).
Displaying data from Multiple Tables (join)
(1) Give details of customers ANIL.
(2) Give name of customer who are borrowers and depositors and having living city nagpur
(3) Give city as their city name of customers having same living branch.
(4) Write a query to display the last name, department number, and department name for all employees.
(5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output
(6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.
(7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.
(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

**Module-7: Transaction Management [8 Hrs]**

Subqueries,Manupulating Data,Transaction management and Concurrency control

**Practice**

To apply the concept of Aggregating Data using Group functions.

(1) List total deposit of customer having account date after 1-jan-96.
(2) List total deposit of customers living in city Nagpur.
(3) List maximum deposit of customers living in bombay.
(4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
(5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.
(6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998
(7) Find the average salaries for each department without displaying the respective department numbers.
(8) Write a query to display the total salary being paid to each job title, within each department.
(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.
(10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.
(11) List the branches having sum of deposit more than 5000 and located in city bombay.
To solve queries using the concept of sub query.
(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT
(2) Give name of customers who are depositors having same branch city of mr. sunil.
(3) Give deposit details and loan details of customer in same city where pramod is living.
(4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.
(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000
(6) Display the last name and salary of every employee who reports to ford.
(7) Display the department number, name, and job for every employee in the Accounting department.
(8) List the name of branch having highest number of depositors.
(9) Give the name of cities where in which the maximum numbers of branches are located.
(10) Give name of customers living in same city where maximum depositors are located.
Manipulating Data
(1) Give 10% interest to all depositors.
(2) Give 10% interest to all depositors having branch vrce
(3) Give 10% interest to all depositors living in n
agpur and having branch city bombay.
(4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844'current department number.
(5) Transfer 10 Rs from account of anil to sunil if both are having same branch.
(6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.
(7) Delete depositors of branches having number of customers between 1 to 3.

(8) Delete deposit of vijay.
(9) Delete borrower of branches having average loan less than 1000.

**To apply the concept of security and privileges.**

**To study Transaction control commands**

VIRTUAL LAB

**TEXT BOOKS**

Database Management Systems: Raghu Ramakrishnan
ORACLE PL/SQL Programming – Scott Urman BPB Publications.

**REFERENCES**

Database Systems Concepts – Henry F Korth, Abraham Silberschatz.
Database Management Systems – Alexis Leon, Mathews Leon – Leon, Vikas Publications