Centurion University of Technology and Management Odisha

Choice Based Credit System

Course Structure & Syllabus

Aerospace Engineering

School of Engineering & Technology

2022

Basket IV
Core Courses
Aerospace Engineering

Course Code	Course Title	Credits	Type T+P+PJ	Prerequisite
CUTM1094	Introduction to Aerospace Engineering	3	2+1+0	
CUTM1095	Rotary-wing Flight Dynamics	3	2+0+1	Introduction to Aerospace Engineering
CUTM1096	Aerodynamic	4	3+1+0	Introduction to Aerospace Engineering and Fluid Mechanics with Finite Volume Method
CUTM1097	Flight Mechanics	6	4+0+2	Aerodynamics
CUTM1098	Aircraft Structure	4	3+1+0	Theories of Failure Using Finite Element Analysis
CUTM1099	Aerospace Structural Analysis	6	3+0+3	Aircraft Structure
CUTM1100	Jet Propulsion	4	3+1+0	Thermodynamics
CUTM1101	Advanced Propulsion	3	2+1+0	Jet Propulsion
CUTM1102	Experimental Aerodynamics	3	2+1+0	Aerodynamics
CUTM1103	Space Dynamics	3	2+1+0	Introduction to Aerospace Engineering
CUTM1104	Introduction to Avionics	3	2+1+0	Introduction to Aerospace Engineering
CUTM1088	Thermodynamics	3	2+1+0	
CUTM1089	Fluid Mechanics with Finite Volume Method	3	2+1+0	
CUTM1062	Theories of Failure Using Finite Element Analysis	4	2+2+0	
CUTM1058	Programming in Java(Same as Java Technologies)	3	2-1-0	

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

Basket IV Core courses Syllabus

Introduction to Aerospace Engineering

Code	Course Title	Credit	T-P-PJ
CUTM1094	Introduction to Aerospace Engineering	3	2-1-0

Objective

- Student will study this course to gather knowledge about the atmospheric condition with change in altitude, different component and its functions of aircraft, basic working principles behind the flight and different types of engine

Course outcome

- Learn the Atmospheric parameter changes with altitude
- Ability to identify the types & classifications of components and control systems
- An ability to differentiate the types of fuselage and constructions.
- Understand the basic concepts of flight
- Different types of Engines and working principles

Course content

Module I: Aerospace vehicle and atmosphere (3hrs)
Introduction to aerospace engineering, Different aerospace vehicle / airship, Atmosphere,

Practice- Write a program for variation of temperature, pressure and density with variation of altitude within troposphere and stratosphere.

Module II: Airplane and their main element (5hrs)
Fuselage, Wing, Empennage, Propulsion,
General aviation-Purposes, history, Deferent configuration,
Commercial Aircraft- Purposes, history, Deferent configuration,
Military Aircraft- Purposes, history, Deferent configuration,

Practice- Draw 3-view diagram of commercial aircraft (Cessna 152) using Dassault system

Module III: Basic Aerodynamics (6hrs)
Incompressible flow, Lagrangian method, Eulerian method
Continuity, momentum and energy equations

Bernoulli's Equation and Conda Effect
Compressible flow and Mach No

Module IV: Forces and moment on aircraft (7hrs)

Aerodynamic Forces and its dependencies, force Equilibrium, Lift and Drag description,
Airfoil, Angle of attack, Bernoulli effect, Equation of lift and drag, Cl-alfa curve,
3D wing: Lift, Drag, Force distribution over wing, Down wash and induced drag, Wing tip, Wing configuration,
High Lift Devices, Flap and Slat, deferent types of flap, Spoiler,
Turbulence and Stall: Laminar and turbulent Flow, Its impact on airfoil, Stall, 3D stall,

Practice- Find the lift and drag of 2 D airfoil (NACA 0012) at 2 degree angle of attack using Dassault system

Module V: Airplane Propulsion (5hrs)

Jet Engine Properties: Definition and overview, Component, Different type,
Inlets: Overview, Supersonic inlet, Different example,
Compressors: Overview, Types, Working principle,
Turbine and Nozzle: Overview, Afterburner,
Compressors: Multistage compressor in jet engine
Turbojet and Turbofan review: working principle, advantages and disadvantages

Practice- Study the difference between Turbojet and Turbofan engine.

Module VI: Flight Mechanics (5hrs)

Center of Gravity, variation of Center of Pressure with angle of attack
Aerodynamics Center, Stability
Control surface and maneuver: Overview, all the moments and Rotational axis, primary control surface, maneuvering, Aileron, Elevator and Rudder.

Practice- *Find out Cl, Cd and Cl/Cd* at different angle of attack using Dassault system

Module VII: Unmanned Aerial Vehicles (2hrs)

Classifications of UAVs and application, Basic working principle, military, government, Civil

Text Books:

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition , 2015
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

Reference Books:

1. Kermode, A.C. Flight without Formulae, Pearson Education; Eleven edition, 2011
2. L J Clancy: Aerodynamics

Rotary-Wing Flight Dynamics

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1095	Rotary-Wing Flight Dynamics	3	2-0-1	Introduction to Aerospace Engineering

Objective

- Student will study this course to get the knowledge about different types of helicopter, and working principles of the helicopter flight
- At end of this course student able to design a quad copter and able to fly

Course outcome

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- Learn the rotor reaction and how to nullify this reaction
- Ability to identify the types & classifications of components and control systems
- Understand the stability of helicopter
- Understand the principle of VTOL/STOL
- Understand of hovercraft

Course content

Module I: Rotor configuration (3hrs)

Introduction to rotary wing aircraft and Torque reaction, Different configurations to nullify the Torque reaction – Jet rotors and compound helicopters

Module II: Methods of Control (4hrs)

Problem in rotary wing with compare to fixed wing aircraft, Methods of Control, rotor blade pitch control, –Collective pitch and and Cyclic pitch – Lead – Lag and flapping of rotor blade

Module III: Hovering and Vertical Flight (7hrs)

Hovering performance – Momentum Theory, Blade element theories – Figure of merit – Profile and induced power estimation – Constant Chord and ideal twist rotors, Ground effect.

Module IV: Forward Flight (8hrs)

Forward flight , Induced, profile and parasite power requirements in forward flight – Performance curves with effects of altitude, Hub Loads, Sideward Flight, Rearward Flight, Turning Flight, Autorotation.

Module V: Helicopter Trim and Stability (4hrs)

Equilibrium condition of helicopter, Trim analysis, Basics of helicopter stability.

Module VI: VTOL and STOL (5hrs)

Various configurations – propeller, rotor, ducted fan and jet lift – Tilt wing and vectored thrust – Performance of VTOL and STOL aircraft in hover, transition and forward motion.

Module VII: Ground Effect Machines (4hrs)

Hovering Flight, lift augmentation and peripheral jet machines – Drag of hovercraft on land and water –Applications of hovercraft.

Text Books:

1. Gupta, L., Helicopter Engineering, Himalayan Books, 1996
2. Gessow, A.and Myers, G. C., Aerodynamics of Helicopter, MacMillan & Co., 1987.

Reference Books:

1. Johnson, W., Helicopter Theory, Princeton University Press, 1980.
2. MacCromick, B. W., Aerodynamics of V/STOL Flight, Academic Press, 1987.

Source of reference; NPTL

https://nptel.ac.in/courses/101/104/101104017/,

Project- Design and Build a small quad copter and fly it. Use Dassult system for designing.
Steps:

1. Comparative configuration study of different types of quad copter.
2. Comparative study of specification and performance details of quad copter
3. Preparation of Comparative data sheets
4. Comparative graphs preparation and selection of main parameters for the design purpose of the quad copter
5. Preliminary main parameters Power plant selection , and control
6. Build the quad copter
7. Detailed stability check at ground.
8. Flight testing
9. Documentation

Aerodynamic

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1096	Aerodynamic	4	3-1-0	Introduction to Aerospace Engineering and Fluid Mechanics with Finite Volume Method

Objective

- To make the student understand the 2-D flow ideal and real flow.
- To make the student understand the concept of viscous flow.
- To make the student understand the deferent types of drag.
- To make the student understand the compressible effect over wing.

Course outcome

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- Using Dassault system
- Compare the CFD data with experimental and analyzing
- Ability to estimate aircraft drag (low speed & high speed)
- Understanding of sensitivity of aircraft drag to various aircraft parameters
- Designing the high speed aircraft and nozzle

Course content

Module I: Two dimensional Flow (4hrs)

Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows. Kutta Joukowski's theorem. D'Alembert Paradox, Magnus effects.

Practice- Pressure distribution over cylinder with and without circulation using 3DS

Module II: Viscous Flow (5 hrs)

Reynolds number, laminar flow, transition flow and turbulent flow, Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness,

Practice- Flow over a flat plate at different Reynolds no using Dassault system.

Module III: Flow separation and control techniques (4 hrs)

Boundary Layer growth and point of separation, Techniques to control the point of separation, Flow over different contours.

Practice- Flow over a flat plate at different angles of incidence using Dassault system.

Module IV: Aerodynamics Drag (4 hrs)

Aerodynamics parameter, Wing tip vortex, down wash, different types of drag method to minimizing those. Aerodynamic efficiency and dependency,

Practice- Compare the Lift, drag and aerodynamic efficiency at different angle of attack of an airfoil using Dassault system and wind tunnel.

Practice- Design and simulate nacelles, intakes and nozzles using Dassault system

Module V: Shock Wave (4 hrs)

Normal shock and equations, Oblique shocks and corresponding equations, θ- β- M relation, Hodograph and pressure turning angle, shock polar, flow past wedges. strong, weak and detached shocks .

Practice- Design and simulate the flow over nacelles, intakes and nozzles using Dassault system

Module VI: Expansion Waves, Rayleigh And Fanno Flow (5hrs)

Rayleigh and Fanno Flow. Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion waves, Methods of Characteristics, Two dimensional supersonic nozzle contours.

Practice- *Find out pressure and velocity distribution in high speed jet using* Dassault system *also using experimental and compare the results.*

Module VII: Airfoil in High Speed Flows (4hrs)

Critical Mach numbers, Lift and drag divergence, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

Practice- Design the different swept back wing and check the effect on transonic speed using Dassault system

Text Books:

1. Clancey, L.J., “Aerodynamics”,

2. Anderson Jr., D., - "Modern compressible flows", McGraw-Hill Book Co., New York 2012.

Reference Books:

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2012. Anderson, Jr., J.D. Introduction to Flight, McGraw-Hill International Edition, 1999

Flight Mechanics

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1097	Flight Mechanics	6	4-0-2	Aerodynamics

Objective

- To understand performance of aircraft
- To understand static and dynamic stability of aircraft
- Get basic knowledge of aircraft designing

Course outcome

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- Effectively use performance calculations for Aircraft design project
- Understand the accelerated flight performance
- Understand takeoff and landing performance
- Effectively use and understand stability for Aircraft.
- Able to understand the process of aerodynamic designing

Course content

Module I: Drag and power required for Steady level flight (5hrs)

Steady level flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, maximum level flight speed, minimum drag and minimum power required,

Module II: Un-Accelerated flight performance (6 hrs)

Range and Endurance of Propeller and Jet airplanes steep angles of climb, Rate of climb, Maximum Climb angle and Maximum Rate of climb, Absolute and service ceiling, Gliding flight

Module III: Take-off and landing performance (4 hrs)

Estimation of take-off and landing distances, Methods of reducing landing distance

Module IV: Turning performance (6 hrs)

Level turn, minimum turn radius, bank angle and load factor, Pull up and pull down maneuvers, maximum turn rate, Constraints on load factor, V-n diagram.

Module V: Longitudinal stability (8 hrs)

Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation

- Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric

Module VI: Lateral and Directional stability(7 hrs)

Lateral stability and Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

Module VII: Control surface and stick forces (4hrs)

Ailerons, elevators, rudder, trim, spring tabs, wing flaps and spoilers. Use of trim tab, Hinge moment and stick forces. Effect of CG on stick forces.

Text Books:

1. Clancey, L.J., "Aerodynamics",

2. Anderson, Jr., J.D. Aircraft Performance and Design, McGraw-Hill International

3. Perkins C.D. & Hage R.E. Airplane performance, stability and control, John Wiley

& Sons 1976.

4. Daniel P. Raymer, Aircraft Design: A Conceptual Approach

Reference Books:

3. Houghton,E.L. and Carruthers, N.B. Aerodynamics for engineering students, Edward Amold Publishers, 1988.

4. Anderson, Jr., J.D. Introduction to Flight, McGraw-Hill International Edition, 1999

5. Nelson, R.C. Flight Stability & Automatic Control, McGraw Hill, 1998.

Project- Students need to a design an aircraft as per their choice, build a small scale model and fly it. Designing and testing need to be done using Dassault system and wind tunnel. Structural part is not included in this scope of work

Steps:

10. Comparative configuration study of different types of aircraft.
11. Comparative study of specification and performance details of aircraft
12. Preparation of Comparative data sheets
13. Comparative graphs preparation and selection of main parameters for the design purpose of the aircraft

14. Preliminary weight estimations, selection of main parameters Power plant selection , aerofoil selection , wing , tail and control surfaces
15. Preparation of layouts of balance diagram and three view diagrams for the aircraft
16. Estimation of drag and preparing drag polar curve
17. Detailed performance calculations and stability analysis.
18. Make wind tunnel testing and compare with simulation result
19. Flight testing
20. Documentation

Aircraft Structures

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1098	Aircraft Structures	4	3-1-0	Theories of Failure Using Finite Element Analysis

Objective

- To understand on analysis of aircraft structural components.
- To study the properties of materials used in Aircraft structure.
- To study the shear flow of different section.
- To study stress analysis of wing and fuselage

Course outcome

- Analyse the truss structure and find forces acting in the individual members deflections of the truss with the nature using different methods.
- Calculate the reaction forces for indeterminate beams. Should be able to draw shear force and bending moment diagrams for indeterminate beams using different methods.
- Calculate the bending stresses in unsymmetrical sections using different
- Calculate crippling load of columns and beam columns with various end conditions using Euler's method and Rankine's formula.
- Analyse the buckling and crippling characteristics of rectangular shear panels.

Course content

Module I: STATICALLY INDETERMINATE STRUCTURES (4hrs)

Shear force and bending moment of fixed-fixed beam, Propped cantilever beam, Continuous beam, Clapeyron's Three Moment Equation, Moment Distribution Method.

Practice: Bending stress of a indeterminate beams using 3D Experience Tool

Module II: ENERGY METHODS (5hrs)

Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications. Energy theorems – dummy load & unit load methods – energy methods applied to statically determinate and indeterminate beams, frames & trusses. Deflection of indeterminate beams using energy method and unit load method

Practice: Deflection of beams using Dassult System Experience Tool

free and forced Vibration of a Cantilever Beams using 3D Experience Tool

Module III: SHEAR FLOW IN OPEN SECTIONS (6hrs)

Thin walled beams, Concept of shear flow and shear centre, Elastic axis. Shear flow in single and multi cell under bending with walls effective and ineffective, one axis of symmetry, unsymmetrical beam sections. Structural constraint, Shear stress distribution in constrained open sections

Practice: Locate Shear Centre for open section

Module IV: SHEAR FLOW IN CLOSED SECTIONS (5hrs)

Bredt-Batho formula, Shear flow in single and multi, cell closed structures under bending and torsion, Shear stress distribution in constrained closed sections,

Practice: Locate Shear Centre for closed section

Determination of Principal axis of Unsymmetrical beams

Module V: BUCKLING OF PLATES (5hrs)

Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections.

Practice: Buckling load estimation of thin plates using 3DS / experimental

Module VI: CRIPPLING OF PANELS (4hrs)

Crippling stresses by Needham's and Gerard's methods. Thin walled column strength. Sheet stiffener panels. Effective sheet width, inter rivet and sheet wrinkling failures

Practice: Shear failure of bolted and riveted Joints using

Module VII: STRESS ANALYSIS OF WING AND FUSELAGE (3hrs)

shear force and bending moment distribution over the aircraft wing and fuselage

Practice: Stress Analysis of Wing and Fuselage using 3D Experience Tool

Text Books:

1. T.M.G. Megson, “Aircraft Structures for Engineering Students”, Fifth edition, Butterworth-Heinemann, 2012.
2. D.J. Peery, “Aircraft Structures”, Dover Publications Inc., 2011.
3. E.H. Bruhn. ‘Analysis and Design of Flight Vehicles Structures’, Tri-state off- set company,USA, 1985.
4. Timoshenko. S. and Young D.H. - "Elements of strength materials Vol. I and Vol. II"., T. Van Nostrand Co-Inc Princeton-N.J. 1990.

Reference Books:

1. B.K. Donaldson, "Analysis of Aircraft Structures - An Introduction", Second edition, Cambridge University Press, 2012.
2. Howard D Curtis, ‘Fundamentals of Aircraft Structural Analysis’, WCB- McGraw Hill, 1997.
3. R.M. Rivello, “Theory and Analysis of Flight Structures”, McGraw Hill, 1993

E-BOOK

http://www.freeengineeringbooks.com/AeroSpace/Aircraft-Structures-Books.php

http://libguides.hcc.hawaii.edu/aero

http://www.jdrr.yolasite.com/resources/Aeronautical_Engineering/BOOKS/Aircraft%20Structures%20by%20Megson%20-%20Book.pdf

Aerospace Structural Analysis

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1099	Aerospace structural Analysis	6	3-0-3	Aircraft Structure

Objective

- To provide the students an understanding on Aerospace Structures and Materials components.
- To study the shear stresses in wing, fuselage, wing spar, attachments
- To study velocity and load diagram for different condition

Course outcome

- Understand Aerospace Structures and Materials
- Understand load paths and demonstrate the knowledge of structural behaviour in fuselage and wing structures
- Calculate the stresses in wing, fuselage, wing spar, attachments
- Differentiate and analyze the types of aircraft fittings, bolt fittings, Riveted connections and their failures.
- Estimate the load of aircraft at different condition
- Able to complete structural design of aircraft

Course content

Module I: Aerospace Structures and Materials uses (6hrs)

monocoque, semimonocoque, corrugated, sandwich structure, reinforced and honeycomb structures, aerospace materials, metallic and non metallic materials, use of aluminum alloy, titanium, stainless steel, composite and ceramic materials.

Module II: ANALYSIS OF WINGS (5hrs)

Basics of aircraft components and functions of parts, Construction concepts for wing, control surfaces and tail plane. Analysis of multi-cell wing structures for bending, shear and torsional loads. Method of successive approximation, analysis of ribs, cut outs in wings.

Module III: ANALYSIS OF FUSELAGE (4hrs)

Construction concepts for fuselage, Analysis of fuselage structures for bending, shear and torsional loads. Analysis of fuselage frames, cut outs in fuselages.

Module IV: ANALYSIS OF WING SPAR (5hrs)

Types of spar construction, diagonal tension concept, semi-diagonal tension concept, design of spar web: shear resistant, diagonal tension, semi-diagonal tension web. Analysis of parallel and tapered spar.

Module VI: AIRCRAFT FITTINGS AND CONNECTIONS (6 hrs)
Types of aircraft fittings, Wing to spar attachments, Single bolt fittings, Multi bolt fittings, Bolt group analysis, Shear, bending and tensile failures of bolts, Analysis of lugs to normal and oblique loadings. Riveted connections and strength of rivets.

Module VII: V-N DIAGRAM WITH GUST LOAD(3 hrs)
Loads on an aircraft for different condition, V-n diagram,

Project- Students are expected to complete following

- Perform structural calculations establish the structural requirements and constraints apprehend the applicable structural standards for an aircraft
- Perform structural calculations such as buckling, natural mode and frequencies, fatigue, flutter speed, reserve factor, stress analysis on various aircraft sections and design concepts for appropriate aircraft loads. Various analyses to be performed are free-free analysis, normal modes, linear and nonlinear analysis, buckling and post buckling analysis.
- Joint and fastener calculations, attachment lugs etc.
- Perform fatigue life and crack growth analysis through selection of critical primary and secondary locations on structure
- Carry out optimization on the finalized design concepts and make final layout.

Steps:

1. V-n diagram for design study
2. Critical loading performance and final V-n graph calculation
3. Gust and maneuverability envelopes.
4. Structural design study- Theory approach
5. Load estimation of wings
6. Wing spar and stringer calculation
7. Wing shear flow calculation
8. Load estimation of fuselage
9. Fuselage shear flow calculations
10. Design of miscellaneous members
11. Detailed structural layouts.
12. Complete the documentation

Text Books:

1. T.M.G. Megson, “Aircraft Structures for Engineering Students”, Fifth edition, Butterworth- Heinemann, 2012.
2. E.H. Bruhn, “Analysis and Design of Flight Vehicles Structures”, Tri-state off- set company, USA, 1985.
3. D.J. Peery and J.J. Azar, “Aircraft Structures”, 2nd edition, McGraw – Hill, N.Y., 1999.
4. S. Timoshenko and D.H. Young, “Elements of strength materials Vol. I and Vol. II"., T. Van Nostrand Co-Inc Princeton-N.J. 1990.

Reference Books:

1. B.K. Donaldson, "Analysis of Aircraft Structures - An Introduction", Second edition, Cambridge University Press, 2012.
2. Howard D Curtis, ‘Fundamentals of Aircraft Structural Analysis’, WCB- McGraw Hill, 1997.
3. R.M. Rivello, “Theory and Analysis of Flight Structures”, McGraw Hill, 1993.

E-BOOK

https://www.researchgate.net/publication/258630500_Aerospace_Structures_for_Engineers

http://www.jdrr.yolasite.com/resources/Aeronautical_Engineering/BOOKS/Aircraft%20Structures%20by%20Megson%20-%20Book.pdf

Jet Propulsion

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1100	Jet Propulsion	4	3-1-0	Thermodynamics

Objective

- To provide concepts of engine components of jet propelled engines which are operated in atmosphere

Course outcome

- Understand the internal flow and external characteristics near the inlets. Starting problems and different modes of operation in supersonic inlets.
- Know the types and working principles of axial compressors and centrifugal compressors its velocity diagrams, blade design and performance characteristics of compressors.
- Understand the types and working methods in combustion chambers. The flame stabilization and flame techniques.
- Understand the flow through nozzle, choking, losses in nozzle, variable area nozzle and thrust vectoring.

Course content

Module I: INTRODUCTION TO AIRCRAFT PROPULSION (4hrs)
Introduction to propulsion , Fundamental equations, Types of aircraft engines Performance parameters , thrust equation , factors affecting thrust and efficiencies.

Practice: Assembly of an aircraft piston engine and Study of an aircraft piston engine, various components, their functions and operating principles

Module II: DIFFUSER (5hrs)
Subsonic inlet and Internal flow, Major features of external flow, Relation between minimum area ratio and external deceleration ratio, Supersonic inlets, Starting problem on supersonic inlets, Shock swallowing by area variation, External deceleration, Modes of inlet operation.

Practice: Velocity and pressure variation in a diffuser using 3DS as well as using apparatus

Module III: AXIAL COMPRESSOR (5hrs)
Working principle of axial compressor, Elementary theory, Velocity triangles, Degree of reaction, Three dimensional flow, Compressor blade design & stage performance calculation, Factors affecting stage pressure ratio , off design performance, Axial compressor performance characteristics.

Practice: Assembly of an aircraft jet engine compressor

Module IV: CENTRIFUGAL COMPRESSOR (4hrs)

Working principle of centrifugal compressor, Work done and pressure rise, Inducer and impellor, Velocity diagrams, Compressor stage design, Concept of pre whirl, Rotation stall, Centrifugal compressor performance characteristics.

Practice: Cascade testing of a model of axial compressor blade row

Module V: COMBUSTION CHAMBERS (4hrs)

Classification of combustion chambers, Important factors affecting combustion chamber design, Combustion process, Combustion chamber performance, Effect of operating variables on performance, Flame tube cooling, Flame stabilization, Use of flame holders, Numerical problems.

Practice: Determination of heat of combustion of aviation fuel

Module VI: NOZZLES (4hrs)

Theory of flow in isentropic nozzles, Convergent nozzles and nozzle choking, Nozzle throat conditions, Nozzle efficiency, Losses in nozzles, Over expanded , under expanded nozzles , Ejector and variable area nozzles

Practice: Velocity and pressure variation in a high speed nozzel using 3DS

Module VII: AFTERBURNER AND THRUST AUGMENTATION (3hrs)

Working principle of afterburner, afterburner augmentation, Thrust and efficiency,

Practice: Characteristic plots of a free jet through a non circular and circular orifice using high speed jet

Text Books:

1. N.K.Giri Automobile Engineering ,Khanna Publishers 2014
2. Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2010

Reference Books:

1. Hill,P.G.&Peterson,C.R."Mechanics&ThermodynamicsofPropulsion"Addison-WesleyLongman INC, 2014
2. V Ganesan, “Gas Turbines”,McGraw-Hill Education, 2010
3. Mathur,M.L and Sharma,R.P, "Gas Turbine Jet and Rocket Propulsion", Standard Publishers &Distributors,Delhi,2014

Advanced Propulsion

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1101	Advanced Propulsion	3	2-1--0	Jet Propulsion

Objective

- To explore Ramjet, Scram jets and supersonic combustion working principles.
- To impart practical knowledge of solid and liquid propellants
- To determine practically thrust developed by rocket propellants.

Course outcome

- The operating principle of ramjet, combustion and its performance.
- The solid rocket operating principles and components of solid rocket motor.
- In detail about liquid propellant rockets and the various types of propellants used with their burning rates.
- About electric, ion and nuclear rockets. The basics of solar sails and its operating principle.
- Apply the concept of sacramjet design of inlets and its hypersonic applications

Course content

Module I: RAMJET PROPULSION (4hrs)

Operating principle, Sub critical, critical and supercritical operation, Combustion in ramjet engine, Ramjet performance.

Practice: Wall pressure measurements of a subsonic diffusers and ramjet ducts

Module II: SCRAMJET PROPULSION (4hrs)

Introduction to scramjet, operating principle, Combustion in scramjet engine, Pulse jet, difference between Ramjet scramjet

Practice: Velocity profiles of wall jets.

Module III: SUPERSONIC COMBUSTION (4hrs)

Fundamentals of hypersonic air breathing vehicles, Preliminary concepts in engine airframe integration, Various types of supersonic combustors, Requirements for supersonic combustors, Performance estimation of supersonic combustors.

Practice: Flame stabilization studies using conical and hemispherical flame holders

Module IV: ROCKET PROPULSION (6hrs)

Operating principle, specific impulse of a rocket, internal ballistics, performance characteristics of rockets, simple rocket design problems, types of igniters, Rocket nozzle classification, preliminary concepts in nozzle, less propulsion, air augmented rockets, pulse rocket motors, static testing of rockets & instrumentation, safety considerations

Practice: Wall Pressure measurements of supersonic nozzle

Module V: SOLID PROPELLANT ROCKETS (4hrs)

Solid propellant rockets, Selection criteria of solid propellants, hazards, Important hardware components of solid rockets, Propellant grain design considerations, combustion of solid propellants, Numerical problems.

Practice: Preparation of solid propellant

Module VI: LIQUID PROPELLANT ROCKETS (4hrs)

Liquid propellant rockets, Selection of liquid propellants, Thrust control in liquid rockets, Cooling in liquid rockets, Limitations of hybrid rockets, Relative advantages of liquid rockets over solid rockets, Numerical Problems.

Practice: Determination of Thrust and heat of combustion of aviation fuel.

Module VII: ADVANCED PROPULSION SYSTEMS (4hrs)

Electric rocket propulsion: Electrostatic , Electro thermal ,Electro magnetic thruster, Ion propulsion techniques, Nuclear rocket propulsion: Types , applications, Solar propulsion system, solar sail.

Text Books:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

Reference Books:

1. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988. Basics of scramjet engine and integral ram engine.

http://nptel.ac.in/courses/101106033/

http://nptel.ac.in/courses/101101001/

http://nptel.ac.in/courses/101101002/

https://www.youtube.com/watch?v=HESOat2iPzU

Advanced Propulsion

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1101	Advanced Propulsion	3	2-1--0	Jet Propulsion

Objective

- To explore Ramjet, Scram jets and supersonic combustion working principles.
- To impart practical knowledge of solid and liquid propellants
- To determine practically thrust developed by rocket propellants.

Course outcome

- The operating principle of ramjet, combustion and its performance.
- The solid rocket operating principles and components of solid rocket motor.
- In detail about liquid propellant rockets and the various types of propellants used with their burning rates.
- About electric, ion and nuclear rockets. The basics of solar sails and its operating principle.
- Apply the concept of sacramjet design of inlets and its hypersonic applications

Course content

Module I: RAMJET PROPULSION (4hrs)

Operating principle, Sub critical, critical and supercritical operation, Combustion in ramjet engine, Ramjet performance.

Practice: Wall pressure measurements of a subsonic diffusers and ramjet ducts

Module II: SCRAMJET PROPULSION (4hrs)

Introduction to scramjet, operating principle, Combustion in scramjet engine, Pulse jet, difference between Ramjet scramjet

Practice: Velocity profiles of wall jets.

Module III: SUPERSONIC COMBUSTION (4hrs)

Fundamentals of hypersonic air breathing vehicles, Preliminary concepts in engine airframe integration, Various types of supersonic combustors, Requirements for supersonic combustors, Performance estimation of supersonic combustors.

Practice: Flame stabilization studies using conical and hemispherical flame holders

Module IV: ROCKET PROPULSION (6hrs)

Operating principle, specific impulse of a rocket, internal ballistics, performance characteristics of rockets, simple rocket design problems, types of igniters, Rocket nozzle classification, preliminary concepts in nozzle, less propulsion, air augmented rockets, pulse rocket motors, static testing of rockets & instrumentation, safety considerations

Practice: Wall Pressure measurements of supersonic nozzle

Module V: SOLID PROPELLANT ROCKETS (4hrs)

Solid propellant rockets, Selection criteria of solid propellants, hazards, Important hardware components of solid rockets, Propellant grain design considerations, combustion of solid propellants, Numerical problems.

Practice: Preparation of solid propellant

Module VI: LIQUID PROPELLANT ROCKETS (4hrs)

Liquid propellant rockets, Selection of liquid propellants, Thrust control in liquid rockets, Cooling in liquid rockets, Limitations of hybrid rockets, Relative advantages of liquid rockets over solid rockets, Numerical Problems.

Practice: Determination of Thrust and heat of combustion of aviation fuel.

Module VII: ADVANCED PROPULSION SYSTEMS (4hrs)

Electric rocket propulsion: Electrostatic , Electro thermal ,Electro magnetic thruster, Ion propulsion techniques, Nuclear rocket propulsion: Types , applications, Solar propulsion system, solar sail.

Text Books:

3. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.
4. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

Reference Books:

3. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
4. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988. Basics of scramjet engine and integral ram engine.

http://nptel.ac.in/courses/101106033/

http://nptel.ac.in/courses/101101001/

http://nptel.ac.in/courses/101101002/

https://www.youtube.com/watch?v=HESOat2iPzU

Experimental Aerodynamics

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1102	Experimental Aerodynamics	3	2-1-0	Aerodynamics

Objective

- To provide knowledge about different types of wind tunnel and limitations
- Knowledge about experimental instruments.

Course outcome

- To provide about the subsonic and high speed wind tunnel
- To provide Knowledge on measurement techniques in aerodynamic flow
- To cover both operating and application procedures of hot wire anemometer.
- To describe flow visualization techniques and to highlight in depth discussion of analog methods.

Course content

Module I: Subsonic wind tunnels (4 hrs)

Non-dimensional numbers Layout of open circuit and closed circuit subsonic wind tunnels – design parameters-energy ratio - HP calculations. Calibration

Practice- Calibration of subsonic wind tunnel

Module II: Instruments and measurement in subsonic flow (5 hrs)

Pressure, velocity and temperature instruments and measurements, Force measurements – types of balances, Three component and six component balances. Wind tunnel balance (Wire balance, Strut-type, Platform-type , Yoke-type -Pyramid type) and Strain gauge balance

Practice- Lift, Drag and moment measurement by using six component balances

Module III: High Sped Wind tunnel (5 hrs)

Blow down, in draft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels, their peculiarities and calibration. Helium and gun tunnels, Shock tubes,

Module IV: Experiments In High Speed Tunnels (4 hrs)

Mach number estimation in test section by pressure measurement and using a wedge – preliminary estimates of blowing and running pressures, nozzle area ratios, mass flow for a given test section size and Mach number.

Practice- Velocity and pressure distribution in a supersonic nozzle.

Module V: Special problem in testing (4 hrs)

Pitot-static tube correction for subsonic and supersonic Mach numbers. Geometric, dynamic and kinematic similarity. Solid blockage, horizontal bounce, Calibration of instruments.

Module VI: Hot wire anemometer and laser Doppler anemometer (4 hrs)

Hot wire anemometer and laser Doppler anemometer for turbulence and velocity measurements-Use of thermocouples and pyrometers for measurement of static and total temperatures-Use of pressure transducers, Rotameters and ultrasonic flow meters.

Practice- - boundary layer velocity profile on a flat plate using Hot wire anemometer

Module VII: Flow Visualization Methods (4 hrs)

Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

Practice- Flow Visualization in subsonic and supersonic flow (Smoke technique in subsonic and Schlieren systems in supersonic flow.

Text Books:

1. *Name of Author, Title, Publication, Edition*

2. Rae W.H and Pope. A "Low speed wind tunnel testing" John Wiley Publication, 1984

3. Rathakrishnan. E "Instrumentation, Measurement and Experiments in Fluids", CRC

Press, London, 2007

Reference Books:

1. Pope. A and Goin. L "High speed wind tunnel testing" John Wiley, 1985
2. Bradsaw "Experimental Fluid Mechanics", Elsevier, 2nd edition, 1970.

Space Dynamics

Code	Course Title	Credit	T-P-PJ	Prerequisite	T
CUTM1103	Space Dynamics	3	2-1-0	Introduction to Aerospace Engineering	

Objective

- Understand the basic concepts of space mechanics and the general N- body.
- Study satellite injection and satellite orbit perturbations.
- Acquire the knowledge of interplanetary and ballistic missile trajectories.

Course outcome

- Understand solar time, solar system, and associated basic terms.
- Gain knowledge of satellite orbits relation between position and time.
- Understand satellite orbit transfer, special perturbations.
- Can know about the various phases inmissilelaunching.
- Able to learn about the spacecraft trajectories between planets.

Course content

Module I: Basic Concepts (3 hrs.)

The solar system, reference frame and coordinate systems, the celestial sphere, the ecliptic, sidereal time, solar time, standard time, the earth atmosphere, basic vector calculus, kinematics, Euler's angles.

Module II: Space Environment (3hrs.)

Peculiarities of space environment and its description, effect of space environment on materials of spacecraft structure and astronauts, manned space missions, effect on satellite lifetime.

Module III: The General N-Body Problem (4 hrs.)

Kepler's laws of planetary motion, Newton's universal law of gravitation, The many body problem, circular restricted three body problem, liberation points, two body problem, satellite orbits, relation between position and time, orbital element.

Module IV: Satellite Injection (2 hrs.)

General aspects of satellite injections, satellite orbit transfer, various cases, orbitdeviations due to injection errors.

Module V: Satellite Orbit Perturbations (3 hrs.)

Special and general perturbations, Cowell'smethod, Encke's method,method of variations of orbital elements,general perturbations approach.

Module VI: Interplanetary Trajectories (4 hrs.)

Two-dimensional interplanetary trajectories, fast interplanetary trajectories, three-dimensional interplanetary trajectories, launch of interplanetary spacecraft, trajectory estimation about the target planet.

Module VII: Rocket Performance (2 hrs.)

The boost phase, the ballistic phase, trajectory geometry, optimal flights, time of flight, re-entry phase, the position of the impact point, influence coefficients.

Text Books:

1. Cornelisse, J.W., Rocket Propulsion and Space Dynamics, W.H. Freeman & co, 1984.
2. Thomson, Introduction to Space Dynamics, Dover Publications,Revised edition, 2012.

Reference Books:

1. Van de Kamp, P., Elements of Astromechanics, Pitman, 1979
   William E. Wiesel, Space Flight Dynamics, Create Space Independent Publishing Platform, 3rd Edition,2010,ISBN-13: 978-1452879598
2. George P. Sutton and Oscar Biblarz, Rocket Propulsion Elements,Wiley India Pvt. Ltd,7th edition, 2010,ISBN-13: 978-8126525775.

Introduction to Avionics

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1104	Introduction to Avionics	3	2-1-0	Introduction to Aerospace Engineering

Objective

- To introduce the basics of avionics and its need for civil and military aircrafts
- To gain more knowledge on various avionics subsystems

Course outcome

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system

Course content

Module I: INTRODUCTION TO AVIONICS (4hrs)

Need for avionics in civil and military aircraft and space systems, Avionics Systems Essentials – integrated avionics and weapon systems – typical avionics subsystems, design, technologies;

Practice- Addition/Subtraction of binary numbers.

Module II: DIGITAL AVIONICS ARCHITECTURE (4hrs)

Introduction to digital computer and memories, Digital Communication, Digital Data Bus System

Practice- Timer Circuits, Shift Registers, Binary Comparator Circuits.

Module III: AVIONICS SYSTEM ARCHITECTURE (4hrs)

data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629

Practice- Encoder/Decoder Circuits

Module IV: FLIGHT DECKS AND COCKPITS (6hrs)

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

Practice- Addition and Subtraction of 8-bit and 16-bit numbers.

Module V: INTRODUCTION TO NAVIGATION SYSTEMS (4hrs)

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS), Inertial sensors and Inertial Navigation Systems, Multi-sensors Navigation Systems, INS block diagram.

Practice- Interface programming with 4 digit 7 segment Display & Switches & LED‘s

Module VI: SATELLITE NAVIGATION SYSTEMS (5hrs)

GPS, Orbital Mechanics & Clock Characteristics, tmospheric effects on satellite signals, NAVSTAR Global Positioning Systems, Global Orbiting navigation Satellites Systems, Radar & landing systems

Practice- Greatest in a given series & Multi-byte addition in BCD mode

Module VII: AIR DATA SYSTEMS AND AUTO PILOT (4hrs)

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach
warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

Text Books:

1. *Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004*
2. *Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.Reference Books:*

References:

1. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.

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:

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

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.

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

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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):

1111111111222222222233333333334444444445 5

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:

six perfect quality black jewels amazed the governor

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:

Two suggested competitive programs to solve on HackerRank

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

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

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