SEMESTER-V

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech		Branch: Aeronautical
Subject: Aerodynamics-II		Code: BT 550
Total Theory Periods: 48	Total Tutorial Periods: 00	Total Credits: 04

OBJECTIVES:

- To introduce the concepts of compressibility,
- To make the student understand the theory behind the formation of shocks and expansion fans in Supersonic flows.
- To introduce the methodology of measurements in Supersonic flows.

UNIT-I FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW

Compressibility, Continuity, Momentum and energy equation for steady one dimensional flow, compressible Bernoulli's equation, Calorically perfect gas, Mach Number, Speed of sound, Area – Mach number – Velocity relation, Mach cone, Mach angle, One dimensional Isentropic flow through variable area duct, Static and Stagnation properties, Critical conditions, Characteristic Mach number, Area-Mach number relation, Maximum discharge velocity.

UNIT-II SHOCK AND EXPANSION WAVES

Normal shock relations, Prandtl's relation, Hugoniot equation, Raleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks, Θ-β-M relation, Shock Polar, Reflection of oblique shocks, left running and right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple regions, operating characteristics of Nozzles, under expansion, over expansion.

UNIT-III TWO DIMENSIONAL COMPRESSIBLE FLOW

Potential equation for 2-dimensional compressible flow, Linearisation of potential equation, perturbation potential, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule, Linearised supersonic flow, Method of characteristics.

UNIT-IV HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE CONFIGURATION

Critical Mach number, Drag divergence Mach number, Shock Stall, Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircrafts.

UNIT-V SPECIAL TOPICS

Shock-Boundary layer interaction, Wind tunnels for transonic, Supersonic and hypersonic flows, shock tube, Gun tunnels, Supersonic flow visualization, Introduction to Hypersonic Flows, Numerical Analysis of one Dimensional flow.

OUTCOMES:

- Understanding characterstics of fluid flows.
- Knowledge gained in shock phenomenon and fluid waves.
- Understanding fluid flow characteristics over wings airfoils and airplanes.
- Usage of wind tunnels for evaluating flow behaviours.

TEXT BOOKS:

1. Anderson, J. D, Modern Compressible Flow, McGraw-Hill & Co., 2002.
2. Rathakrishnan, E., Gas Dynamics, Prentice Hall of India, 2004.

REFERENCES:

1. Shapiro, A. H., Dynamics and Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., Elements of Gas Dynamics, McGraw- Hill &Co., 1989.
3. Oosthuizen, P. H., & Carscallen,W. E., Compressible Fluid Flow, McGraw- Hill &Co., 1997.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Propulsion-I | Code: BT 551
Total Theory Periods: 48 | Total Tutorial Periods: 00 | Total Credits: 04

OBJECTIVES:

- To introduce basic concepts and salient features of engine components of jet propelled engines which are operated in atmosphere to students.
- This course is also aimed at making students familiarize with advanced jet propulsion methods like hypersonic propulsion.

UNIT-I FUNDAMENTALS OF GAS TURBINE ENGINES

Illustration of working of gas turbine engine–The thrust equation–Factors affecting thrust–Effect of pressure, velocity and temperature changes of air entering compressor–Methods of thrust augmentation–Characteristics of turboprop, turbofan and turbojet–Performance characteristics.

UNIT-II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

UNIT-III COMBUSTION CHAMBERS

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.

UNIT-IV NOZZLES

Theory of flow in isentropic nozzles–Convergent nozzles and nozzle choking–Nozzle throat conditions–Nozzle efficiency–Losses in nozzles–Over expanded and under–expanded nozzles–Ejector and variable area nozzles–Interaction of nozzle flow with adjacent surfaces–Thrust reversal.

UNIT-V COMPRESSORS

Principle of operation of centrifugal compressor–Work done & pressure rise–Velocity diagrams –Diffuser vane design considerations–Concept of pre whirl–Rotation stall–Elementary theory of axial flow compressor–Velocity triangles–degree of reaction–Three dimensional–Air angle distributions for free vortex and constant reaction designs–Compressor blade design–Centrifugal and Axial compressor performance characteristics.

OUTCOMES:

- Ability to identify the engine components of jet propelled engines.
- Know the details of advanced Jet propulsion and hypersonic propulsion.

TEXT BOOKS:

1. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison–Wesley Longman INC, 1999.

REFERENCES:

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Longman, 1989.
2. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985.
3. “Rolls Royce Jet Engine” – Third Edition – 1983.
4. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 1999.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Heat and Mass Transfer | Code: BT 552
Total Theory Periods: 48 Total Tutorial Periods: 00 | Total Credits: 04

OBJECTIVES:
To introduce basic concepts of heat and mass transfer and its application in aerospace.

UNIT-I FUNDAMENTALS
Modes of heat transfer: Conduction – Convection - Radiation

UNIT-II HEAT CONDUCTION
Steady and unsteady state heat conduction in solids - Effect of variation of thermalconductivity on heat transfer in solids – conduction with heat generation – Heat transfer problems in infinite and semi infinite solids–Critical radius of insulation-Extended surfaces-Application of numerical techniques.

UNIT-III FREE AND FORCED CONVECTION
Convection fundamentals: Basic equations, Boundary layer concept, Dimensional analysis
Free Convention: Laminar boundary layer equation- Free convection in atmosphere free convection on a vertical flat plate – Integral method - Empirical relation in free convection – External flows.
Forced convection: Forced convection - Laminar andturbulent convective heat transfer analysis in flows between parallel plates, over a flatplate and in a circular pipe. Empirical relations - numerical techniques in problem solving.

UNIT-IV RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS
Concept of black body-Intensity of radiation-Laws of Black body Radiation-Radiation from non black surfaces- real surfaces – Radiation between surfaces-Radiationshape factors-Radiation shields.
HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger Analysis.

UNIT-V HEAT TRANSFER PROBLEMS IN AEROSPACEENGINEERING
Heat transfer problems in gas turbine combustion chambers - Rocket thrust chambers - Aerodynamic heating - Ablative heat transfer.

OUTCOMES:
Students will be able to understand the basic concepts of heat and mass transfer and its application in aerospace.

TEXT BOOKS:
1 Sachdeva, S.C. Fundamentals of Engineering, Heat and Mass Transfer, Wiley Eastern Ltd., New Delhi, 1981.
2. Lienhard, J.H., “A Heat Transfer Text Book”, Prentice Hall Inc., 1981.
3. Holman, J.P., “Heat Transfer”, McGraw Hill Book Co., Inc., New York, 6th Edn, 1991.

REFERENCES:
1. Sachdeva, S.C., “Fundamentals of Engineering Heat and Mass Transfer”, Wiley Eastern Ltd., New Delhi, 1981.
2. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley and Sons, 5th Edn.1986.

3. Mathur, M. and Sharma, R.P., “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1988.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Aircraft Performance | Code: BT 553
Total Theory Periods: 36 Total Tutorial Periods: 00 | Total Credits: 03

OBJECTIVES:
To make students aware about aircraft performance in steady and level flight, gliding and climbing flight and accelerated flight.

UNIT-I GENERAL CONCEPTS
International Standard atmosphere, IAS, EAS, TAS, Propeller theory- Froude momentum and blade element theories, Propeller coefficients, Use of propeller charts, Performance of fixed and variable pitch propellers, High lift devices, Thrust augmentation.

UNIT-II DRAG OF BODIES
Streamlined and bluff body, Types of drag, Effect of Reynold's number on skin friction and pressure drag, Drag reduction of airplanes, Drag polar, Effect of Mach number on drag polar.

UNIT-III STEADY LEVEL FLIGHT
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, conditions for minimum drag and minimum power required, Effect of drag divergence on maximum velocity, Range and Endurance of Propeller and Jet airplanes.

UNIT-IV GLIDING AND CLIMBING FLIGHT
Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph.

UNIT-V ACCELERATD FLIGHT
Estimation of take-off and landing distances, Methods of reducing landing distance, level turn, minimum turn radius, bank angle and load factor, Constraints on load factor, Pull up and pull down maneuvers, maximum turn rate, V-n diagram.

OUTCOMES:
Students will become aware about aircraft performance in steady and level flight, gliding and climbing flight and accelerated flight.

TEXT BOOKS:
1. Houghton, E. L. and Carruthers, N. B., Aerodynamics for engineering students, Edward Amold Publishers, 1988.
2. Anderson, Jr., J. D. Aircraft Performance and Design, McGraw-Hill International Edition, 1999.

REFERENCES:
1. Kuethe, A.M. and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons, 1982.
2. J. J. Bertin, Aerodynamics for Engineers, Prentice-Hall, 1988.
3. L. J. Clancey, Aerodynamics, Pitman, 1986
4. Anderson, Jr., J.D. Introduction to Flight, McGraw-Hill International Edition, 1999.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Aircraft Structures-II | Code: BT 554
Total Theory Periods: 48 Total Tutorial Periods: 00 | Total Credits: 04

OBJECTIVES:

- To provide the students various methods for analysis of aircraft wings and fuselage.
- To provide the behaviour of major aircraft structural components.

UNIT-I UNSYMMETRICAL BENDING

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized 'k' method, neutral axis method, principal axis method.

UNIT-II SHEAR FLOW IN OPEN SECTIONS

Thin walled beams – concept of shear flow – the shear centre and its determination– shear flow distribution in symmetrical and unsymmetrical thin-walled sections –structural idealization – shear flow variation in idealized sections.

UNIT-III SHEAR FLOW IN CLOSED SECTIONS

Bredt -Batho theory – single-cell and multi-cell tubes subject to torsion – shear flowdistribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear centre of closed sections.

UNIT-IV BUCKLING OF PLATES

Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength estimation – thin-walled column strength – load carrying capacity of sheet stiffener panels – effective width.

UNIT-V STRESS ANALYSIS OF WING AND FUSELAGE

Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage –shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams– semi-tension field beam theory.

OUTCOMES:

- Ability to analyse the aircraft wings and fuselage.
- Ability to demonstrate the behaviour of major aircraft structural components.

TEXT BOOKS:

1. Megson T M G, 'Aircraft Structures for Engineering Students', Edward Arnold, 1995.
2. Bruhn. E. H., 'Analysis and Design of Flight Vehicles Structures', Tri-state off-set company, USA, 1985.
3. Howard D Curtis, 'Fundamentals of Aircraft Structural Analysis', WCB-McGraw Hill, 1997.

REFEENCES:

1. Rivello, R. M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.
2. Peery, D. J., and Azar, J. J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Aircraft Structures Lab | Code: BT 556
Total Practical Periods: 28 | Total Credits: 01

OBJECTIVES:

- To study the properties of materials used in Aircraft structure.
- To study the failure of different component under different loading condition.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using mechanical extensometers.
2. Determination of Young's modulus of aluminium using electrical extensometers.
3. Determination of fracture strength and fracture pattern of ductile and brittle materials.
4. Testing of Riveted Joints.
5. Determination of membrane stresses in a thin cylinder under internal pressure.
6. Deflection of beams with various end conditions and Verification of Maxwell's Reciprocal theorem & principle of superposition.
7. Column – Testing and South – well's plot.
8. Determination of Unsymmetrical bending of different materials using bend test set up.
9. Determination of Shear centre location for open sections.
10. Determination of Shear centre location for closed sections.
11. Experiment on Constant strength beam.
12. Finding out flexibility matrix for cantilever beam.
13. Testing of Beam with combined loading.
14. Wagner beam – Tension field beam experiments.
15. Measurement of Vibrations of beams.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Universal Testing Machine	1	1,2,3,4
2	Mechanical Extensometer	1	1
3	Electrical strain gauge	10	2, 5, 12, 13
4	Strain indicator	1	2, 5, 12, 13
5	Dial Gauges	12	6
6	Beam Test set up with various end conditions	2	6, 8, 9, 10, 11
7	Column Test Apparatus	1	7
8	Thin walled pressure vessel	1	5
9	Unsymmetrical sections like 'Z' sections	2	8, 9, 10
10	Wagner beam	1	14
11	Hydraulic Jack	1	14
12	Amplifier	2	15
13	Exciter	2	15
14	Pick – up	2	15
15	Oscilloscope	2	15

OUTCOMES:

Ability to perform non-destructive testing to predict the properties of metabolic materials used in aircraft application.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Aircraft Structures Repair Lab | Code: BT 557
Total Practical Periods: 28 | Total Credits: 01

OBJECTIVES:
To study the aircraft structure and composite repair techniques.

LIST OF EXPERIMENTS

1. Patch repair welding using TIG.
2. Patch repair welding using MIG.
3. Patch repair welding using Plasma Arc.
4. Exercise on pipe bending.
5. Exercise on Riveted joints & repair work.
6. Exercise on composites & repair work.
7. Repair of Sandwich panels.
8. Exercise on Sheet metal forming.
9. Exercise on cable swaging.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Shear cutter pedestal type	1	6,8
2	Drilling Machine	1 set	5,6,8
3	Bench Vices	1	5,6,8
4	Radius Bend bars	1	4
5	Pipe Flaring Tools / Pipe Bending Tools	1	9
6	Carbide Gas Plant	1	4
7	MIG Weld Plant	1	2
8	TIG Weld Plant	1	1
9	Plasma welding setup	1	3
10	Cable And Swaging Block	1	9
11	Sandwich / Composite Panels	5	6,7

OUTCOMES:
Students will be able to understand and carry out aircraft structure and composite repair techniques.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Propulsion-I Lab | Code: BT 558
Total Practical Periods: 28 | Total Credits: 01

OBJECTIVES:

- To familiarize students and to expose them practically to various aircraft piston and gas turbine engines
- To give practical exposure to various testing methods of variable area ducts, propellants, jet engine components and rockets
- To practically determine the flow behaviour of jets.

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine -assembly of sub systems.
2. Study of an aircraft piston engine -various components, their functions and operating principles
3. Study of an aircraft jet engine - assembly of sub systems,
4. Study of an aircraft jet engine - various components, their functions and operating principles
5. Study of forced convective heat transfer.
6. Study of free convective heat transfer.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Piston engines	2	1
2	Jet Engine /Engine model	1	2
3	Forced Convective apparatus	1	3
4	Free Convective apparatus	1	4

OUTCOMES

- Ability to understand details of piston and gas turbine engine.
- Ability to perform various testing on ducts, propellants, jet engine components.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: CAD/CAM/CAE Lab | Code: BT 559
Total Practical Periods: 28 | Total Credits: 01

OBJECTIVES:

- To teach and train the students in the lab about design and drafting of aero components.
- To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

LIST OF EXPERIMENTS

1. Draw simple line on computer screen translate, rotate reflect 2-D object about any axis and 2-Dimensional object.
2. Draw 3-D object and show scaling, rotation & translation of that object about any particular axis.
3. For given part to be machined, prepare a CNC part program to machine the holes on vertical axis CNC machining centre using the ISO standard G-codes. You may choose Program Zero (Axes) to be used for the component. Show the axes chosen and write the program.
4. For a given component to be machined, prepare a CNC part program to machine the part contour on any vertical axis. Show machining centre using the ISO standard G-codes. Show the axis chosen and write the program using the initial tool position.
5. Prepare a CNC part program for a component to be machined on any turning centre using the ISO standard G-codes. Write the program using the initial tool position.
6. Develop a CNC milling part program in a post processor version to machine the given Component.
7. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
8. Wire frame modeling – surface modeling.
9. Solid Modeling and Advanced modeling.
10. CFD/FEM Fundamentals.
11. Flow Simulation over a Symmetrical Airfoil and Cambered Airfoil Using CFD.
12. Flow Simulation over a Using CFD.
13. Flow Simulation over a Turbine Blade (static analysis) Using CFD.
14. Stress Analysis and Thermal Analysis of a Turbine Blade (Rotation only and no pressure loads).
15. Stress Analysis and Thermal Analysis of Any Aircraft Component.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Computer	30	1 to 15
2	CNC Machine	1	1 to 6
3	Pro-E -Wildfire, AutoCAD (latest), CATIA,SOLIDWORKS	10 licenses	7 to 15
4	ANSYS- 11 with Fluent, NASTRAN, CFX	10 licenses	7 to 15
5	UPS 10 KVa 3 Phase	1	1 to 15

OUTCOMES:

- Ability to design and draw different joints and components using manual drafting method.
- Ability to design and model difficult aero component and perform structural analysis using available software packages

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Total Quality Management | Code: BT 5551
Total Theory Periods: 36 Total Tutorial Periods: 00 | Total Credits: 03

OBJECTIVES:
To facilitate the understanding of Quality Management principles and process.

UNIT-I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality -Dimensions of manufacturing and service quality - Basic concepts of TQM -Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby –Barriers to TQM.

UNIT-II TQM PRINCIPLES
Leadership–Strategic quality planning, Quality statements-Customer focus–Customer orientation, Customer satisfaction, Customer complaints, Customer retention–Employee involvement–Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership–Partnering, Supplier selection, Supplier Rating.

UNIT-III TQM TOOLS & TECHNIQUES I
The seven traditional tools of quality–New management tools–Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT–Bench marking–Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT-IV TQM TOOLS & TECHNIQUES II
Quality circles – Quality Function Deployment (QFD)–Taguchi quality loss function–TPM–Concepts, improvement needs–Cost of Quality– Performance measures.

UNIT-V QUALITY SYSTEMS
Need for ISO 9000- ISO 9000-2000 Quality System –Elements, Documentation, Quality auditing - QS 9000 – ISO 14000 – Concepts, Requirements & Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

OUTCOMES:
The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOKS:
1. Dale H. Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:
1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi, L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd. (2006).
4. Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd. (2006).

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Operation Research | Code: BT 5552
Total Theory Periods: 36 | Total Tutorial Periods: 00 | Total Credits: 03

OBJECTIVES:
To make the students understand fundamentals of operation research alongwith transportation and assignment problems, waiting line theory and simulation, network analysis and game theory.

UNIT-I INTRODUCTION
Introduction to OR: Definition, role of operations research in decision-making, applications in industry, Concept on O.R., model building –Types & methods.
Linear Programming: Programming definition, formulation, solution- graphical, simplex methods, BIG-M methods computational, problems, degeneracy.

UNIT-II TRANSPORTATION AND ASSIGNMENT
Transportation: Introduction, Formulation, optimal solution, unbalanced transportation problem, MODI Method, Stepping Stone method, initial basic feasible solution, degeneracy.
Assignment: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Variants of Assignment Problem, Travelling Salesman Problem.

UNIT-III WAITING LINE THEORY AND SIMULATION
Waiting Line Theory: Basic queuing process, Terminology, Single Channel, basic structure of queuing models, some commonly known queuing situations Kendall's service time, solution to M/M/1: FCFS models.
Simulation: Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

UNIT-IV NETWORK ANALYSIS
Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network. Resource smoothing and leveling, project cost, Optimum project duration, project crashing, updating, Time estimation in PERT.

UNIT-V GAME THEORY
Introduction, two person zero sum game, methods for solving two person zero sum game: when saddle point exists, when no saddle point exists, solution of 2xn and mx2 game
.

OUTCOMES:
Students will be able understand fundamentals of operation research alongwith transportation and assignment problems, waiting line theory and simulation, network analysis and game theory.

TEXT BOOKS:
1. Hira & Gupta, Operation Research – S. Chand Publication.
2. Quantitative Techniques- Vohra, TMH, New Delhi.

REFERENCE BOOKS:
1. Gupta & Sharma, Operation Research-, National Publishers, New Delhi.

2. H.M.Wagher, Principles of operation Research, Prentice Hall of India, New Delhi.
3. Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
4. Operation Research – Philips, Revindran, Solgeberg, Wiley ISE

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech — Branch: Aeronautical
Subject: Computer Aided Design — Code: BT 5553
Total Theory Periods: 36 Total Tutorial Periods: 00 — Total Credits: 03

OBJECTIVES:
To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

UNIT-I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotators) windowing - view ports - clipping transformation.

UNIT-II CURVES AND SURFACES MODELLING
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces- Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder– synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface-surface manipulations.

UNIT-III NURBS AND SOLID MODELING
NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations -primitive instancing -sweep representations -boundary representations-constructive solid Geometry -comparison of representations -user interface for solid modeling.

UNIT IV VISUAL REALISM
Hidden –Line –Surface –solid removal algorithms shading– coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

UNIT-V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE
Assembly modeling -interferences of positions and orientation -tolerances analysis -mass property calculations -mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards.

OUTCOMES:
Ability to design and draw different joints and components using manual drafting method.

TEXT BOOKS:

1. Ibrahim Zeid, CAD / CAM Theory and Practice,TMH, special Indian Edition, 2007.
2. M.P. Groover and E.W. Zimmers, CAD/CAM, PHI, first Edition, 1995.

REFERENCS:

1. P.N. Rao, CAD / CAM Principles and Applications, TMH, Second edition, 2008.
2. David F. Rogers and J. Alan Adams, Mathematical Elements for Computer Graphics, TMH, Second Edition, 2002.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Resource Management Techniques | Code: BT 5554
Total Theory Periods: 36 Total Tutorial Periods: 00 | Total Credits: 03

OBJECTIVES:
To introduce the concept of linear programming, duality and networks, classical optimization theory and object scheduling.

UNIT-I LINEAR PROGRAMMING
Principal components of decision problem –Modeling phases –LP Formulation and graphic solution –Resource allocation problems –Simplex method –Sensitivity analysis.

UNIT-II DUALITY AND NETWORKS
Definition of dual problem –Primal –Dual relationships –Dual simplex methods –Post optimality analysis –Transportation and assignment model –Shortest route problem.

UNIT-III INTEGER PROGRAMMING
Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT-IV CLASSICAL OPTIMISATION THEORY
Unconstrained external problems, Newton –Ralphson method –Equality constraints– Jacobean methods –Lagrangian method –Kuhn –Tucker conditions –Simple problems.

UNIT-V OBJECT SCHEDULING:
Network diagram representation –Critical path method –Time charts and resource leveling – PERT.

OUTCOMES:
Students will be able to understand the concept of linear programming, duality and networks, classical optimization theory and object scheduling.

TEXT BOOKS:

1. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.
2. Vohra, 'Quantitative Techniques in Management', Tata Mc Graw Hill, 2002.

REFERENCES:

1. Paneer Selvam, 'Operations Research', Prentice Hall of India, 2002.
2. Anderson 'Quantitative Methods for Business', 8th Edition, Thomson Learning, 2002.
3. Winston 'Operation Research', Thomson Learning, 2003.
4. Anand Sarma, 'Operation Research', Himalaya Publishing House, 2003.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester: V B.Tech | Branch: Aeronautical
Subject: Theory of Vibration | Code: BT 5555
Total Theory Periods: 36 Total Tutorial Periods: 00 | Total Credits: 03

OBJECTIVES:
To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.

UNIT-I SINGLE DEGREE OF FREEDOM SYSTEMS
Introduction to simple harmonic motion, D'Alembert's Principle, Free vibrations–Damped vibrations –Forced Vibrations, with and without damping – support excitation– Vibration measuring instruments.

UNIT-II MULTI DEGREES OF FREEDOM SYSTEMS
Two degrees of freedom systems - Static and Dynamic couplings – vibration absorber- Principal co-ordinates - Principal modes and orthogonal condition – Eigenvalue problems - Hamilton's principle - Lagrangean equations and application.

UNIT-III CONTINUOUS SYSTEMS
Vibration of elastic bodies - Vibration of strings - Longitudinal - Lateral and Torsional vibrations

UNIT-IV APPROXIMATE METHODS
Approximate methods -Rayleigh's method -Dunkerlay's method – Rayleigh-Ritz method, Matrix Iteration method.

UNIT-V ELEMENTS OF AEROELASTICITY
Vibration due to coupling of bending and torsion-Aero elastic problems – Collars triangle - Wing Divergence - Aileron Control reversal – Flutter – Buffeting.

OUTCOMES:
- Gaining understanding of single and multi degree vibrating systems.
- Ability to use numerical techniques for vibration problems.

TEXT BOOKS:

1. Thomson W T, 'Theory of Vibration with Application' - CBS Publishers, 1990.
2. G.K. Grover, "Mechanical Vibrations", 7th Edition, Nem Chand Brothers, Roorkee, India, 2003.

REFERENCES:

1. Timoshenko S., Vibration Problems in Engineering – John Wiley and Sons, NewYork, 1993.
2. Bisplinghoff R.L., Ashely H and Hogman R.L., Aero elasticity – Addision Wesley Publication, New York, 1983.
3. William W Seto, 'Mechanical Vibrations' – McGraw Hill, Schaum Series.
4. TSE. F.S., Morse, I.F., Hunkle, R.T., Mechanical Vibrations – Prentice Hall, New York, 1984.
5. Leonard Meirovitch, 'Elements of Vibration Analysis' – McGraw Hill International Edition Clarence W DeSilva, `Vibration – Fundamentals and Practice', CRCPress, Special Indian Edition, 200