DEPARTMENT OF AERONAUTICAL ENGINEERING

COURSE COVERAGE SUMMARY

FOR

IV BTECH – I SEMESTER

(2022-2023)

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Sponsored by CMR Educational Society)

(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade – ISO 9001:2008 Certified)

Maisammaguda, Dhulapally (Post Via Hakimpet), Secunderabad – 500100

COURSE COVERAGE SUMMARY

FOR

AVIONICS

IV BTECH – I SEMESTER

(2022-2023)

AVIONICS
COURSE COVERAGE SUMMARY

Unit No	Title of the Unit	Topics of the Unit	Name of The Text Book	Chapter No	Page No
UNIT -I	Introduction To Avionics	Importance and role of Avionics in modern aircraft systems which interfacedirectly with pilot Aircraft state sensor systems, outside world sensor systems, task automationsystems. The avionics equipment and system requirement, environmental, weight, reliability. Standardization and specification of avionics equipment and systems, ARINC and MIL specification. Electricaland optical data bus systems. Integrated modular avionics architectures.	**Avionics – RPG Collins**	**1**	**1-3** **3-5** **11-16** **459-486**

UNIT-II	Display &Man Machine InteractionAnd Communication System	Introduction to displays headup displays(HUD), basic principles, Helmet mounted displays, Head tracking systems. Head down displays Civil cockpit, Military cockpit, Solid state standbydisplay systems, Data fusion in displays Intelligent displaysystems. Introduction to voice and data communication systems HF,VHF,UHFand Satellite communications, Flight data recorders.	**Avionics – RPG Collins**	**2**	**19-36** **36-42** **79**
UNIT-III	Inertial Sensors, Attitude Derivation And Air Data Systems	Basic principles of gyroscope and accelerometers. Introduction to opticalgyroscope, ring laser gyros, principles.Stable platform system, strap down systems, error in inertial systems and corrections. Air data Information and its use, derivation of Air Data Laws and relationship, altitude,static pressurerelationship, variation of ground pressure, Speed of sound, Mach Number, CAS, TAS, Pressure error. Air data sensors andcomputing	**Avionics – RPG Collins**	**5** **7**	**255-282** **377-399**

UNIT – IV	Navigation (Ins And Gps) AndLanding System	Principles of Navigation, Types of Navigation systems, Inertial Navigation System,Initial alignment and Gyro compassing, Strap down INS computing.Landing System, localizer and glide slope,marker systems. Categories of ILS.Global navigation satellite systems, GPS,description and basic principles. Integration of GPS and INS, Differential GPS.	**Avionics – RPG Collins**	**6**	**303-365**

UNIT- V	Surveillance And Auto FlightSystems	Traffic alert and collision avoidance systems(TCAS),Enhanced ground proximity warning system. Weather radar. Autopilots, Basic principle, height control, headingcontrol, ILS coupled autopilot control, satellite landing system, speed control and auto throttle. Flight management systems,principles, flight planning, navigation and Guidance, performance prediction and flight path optimization.	**Avionics – RPG Collins**	**8**	**415-457**

COURSE COVERAGE SUMMARY

FOR

COMPUTATIONAL AERODYNAMICS

IV BTECH – I SEMESTER

(2022-2023)

COMPUTATIONAL AERODYNAMICS
(R18A2116)
COURSE COVERAGE SUMMARY

Unit	Title of the unit	Topics of the unit	Name of thetext book	Chapter No.	Page No.
Unit -1	Introduction to computational fluiddynamics	CFD and its importance as research and design tool, General Procedure of CFD.	John .D. Anderson, Computational Fluid Dynamics, McGraw Hill	1	3- 13
		Application of CFD tovariousEngineering problems.		1	14 - 30
		Models of fluid flow- Finite Control Volume, Infinitesimal Fluid Element,Substantial derivatives, divergence of Velocity.		2	40 - 48
Unit -2	Governing equations of fluid dynamics	The continuity equation, momentum equation, energy equation, physical boundary conditions. Form of	John .D. Anderson, Computational Fluid Dynamics, McGraw Hill	2	49 - 90

		Governing equation suited for CFD - Conservation form - shock fitting and shock capturing.			
		Impact of partial differential equations on CFD. Classification		3	95 -120
		of Quasi-Linear Partial			
		differential equation,			
		The Eigen value			
		method, General behavior of different classes of Partial differential equation – elliptic, parabolic and hyperbolic with examples.			
Unit -3	Discretization techniques	Introduction, Finite differences and formulas for first and second derivatives,	John .D. Anderson, Computational Fluid Dynamics,	4	128 -153

		difference equations, Explicit and implicit approaches.	McGraw Hill			

		Basis of finite volume method- conditions on the finite volume selections- approaches - Cell-centered and cell-vertex. Definition of finite volume discretization general formulation of a numerical scheme.	Charles Hirsch "Numerical computation of internal and external flows" Second Edition Butterworth - Heinemann is animprint of Elsevier	5	209 - 215
Unit -4	Grid generation	Need for grid generation. Structured grids- Cartesian grids, body fitted structured grids, Multi-block grids - overset grids with applications. Unstructured grids- triangular/ tetrahedral cells, hybrid grids, quadrilateral/hexahedra cells. Grid Generation techniques -	Charles Hirsch "Numerical computation of internal and external flows" Second Edition Butterworth - Heinemann is animprint of Elsevier	6	249 -276

		Delaunay triangulation, Advance font method. Grid quality parameters			
Unit -5	Cfd techniques	Lax-Wendroff technique, MacCormack's technique,	John .D. Anderson, Computational Fluid Dynamics, McGraw Hill	6	217- 224
		Alternating-Direction-		6	243 - 247
		Implicit (ADI) Technique, Crank Nicholson technique, Relaxation technique,			
		Pressure correction technique Numerical		6	254- 264

		procedures-SIMPLE algorithm. Boundary conditions for the pressure correction method.			

COURSE COVERAGE SUMMARY

FOR

CAD/CAM

IV BTECH – I SEMESTER

(2022-2023)

COURSE COVERAGE
CAD/CAM
(R18A2137)

TITLE OF THE UNIT	TOPICS OF THE UNIT	NAME OF THE TEXT BOOK	CHAPTER No.	PAGE No.
UNIT-I **Introduction** **Computer** **Graphics**	Computers in Industrial Manufacturing, Product cycle,CAD / CAM Hardware, Basic structure. Raster scan graphics coordinate system, Database structure for graphics modelling, Transformation of geometry, 3D transformations,Clipping.	CAD/CAM: PRINCIPLES AND APPLICATIONS BY P N Rao	I II III	1 TO 15 21 TO 45 53 TO 60 61 TO 70 70 TO 77 77 TO 80 80 TO 86
UNIT–II **Geometric modelling**	Requirements, geometric models, geometric Constructionmodels, Curve representation methods, Surface representation methods, Modelling facilities desired.	CAD/CAM: PRINCIPLES AND APPLICATIONS BY P N Rao	IV	97 TO 122 123 TO 139 139 TO 151 164 TO 168
UNIT-III **Numerical control**	NC, NC modes, NC elements, NC machine toolsStructure of CNC machine tools Features of Machining center turning centerCNC Part Programming fundamentals, Manual part programming methodsComputer Aided Part Programming.	CAD/CAM: PRINCIPLES AND APPLICATIONS BY P N Rao	IX X XII XIII	260 TO 272 274 TO 290 316 TO 331 350 TO 356 356 TO 360 361 TO 398

UNIT-IV **Group Technology**	Part family, coding and classification, Production flow analysis, Advantages and limitations, Computer Aided Processes Planning, Retrieval type andGenerative type	CAD/CAM: PRINCIPLES AND APPLICATIONS BY P N Rao	XVIII	525 TO 532 536 TO 543 549 TO 554
UNIT-V **Computer Aided QualityControl**	Terminology in quality control, the computer in QC,contact inspection methods, Noncontact inspection methods-optical, noncontactinspection methods non-optical, Computer aided testing, Integration of CAQC with CAD/CAM.	CAD/CAM: PRINCIPLES AND APPLICATIONS BY P N Rao	XXIII	694 TO 712
Computer integrated manufacturing systems:	Types of Manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control systems, Human labor in the manufacturing systems, CIMS benefits.		XXIV	715 TO 729

COURSE COVERAGE SUMMARY

FOR

MECHANICAL VIBRATION

IV BTECH – I SEMESTER

(2022-2023)

MECHANICAL VIBRATION
(R18A2118)
COURSE COVERAGE SUMMARY

Unit No.	Title of the Unit	Topics of the Unit	Name of the References/Text books	Chapter No.	Page No.
UNIT-1	Fundamentals of Vibration	Brief history of vibration, Importance of the study of vibration, basicconcepts of vibration,classification of vibrations,vibration analysis procedure, spring elements, mass or inertia elements, damping elements.	Mechanical Vibrations By: Singiresu S. Rao And Mechanical Vibrations By: Dr. V. P. Singh	1 1	1-27 1-9
	Free Vibration of Single Degree of Freedom Systems	Introduction, Free vibration of an Undampedtranslationalsystem, free vibration of an undamped torsional system. Concepts ondifferentdamping conditions	Mechanical Vibrations By: Singiresu S. Rao	2	63-74
UNIT-2	Harmonically Exited Vibrations	Introduction,Equation of motion, response of an undampedsystem under harmonic force, Response of a damped system under harmonic force, forced vibrationwith coulomb damping, forced vibration with hysteresis damping	Mechanical Vibrations By: Singiresu S. Rao	3	152-157 161-164 178-181
UNIT-3	Vibration	Introduction, Response under	Mechanical	4	200-226

	Under General Forcing Conditions	a general periodic force, Two Degree of FreedomSystems, Introduction, Equation of motion for forcedvibration, freevibration analysis of an undamped system, Torsional system, forced vibration analysis	Vibrations By: Singiresu S. Rao	5	251-263 269-274
UNIT-4	Multidegree of Freedom Systems	Introduction, Modeling of Continuous systems as multi degreeof freedom systems, Using Newton's second law to derive equations of motion,Determination of Natural Frequencies and ModeShapes:Introduction, Dunkerley's formula, Rayleigh's method, Holzersmethod, Matrix iteration method,Jacobi's method.	Mechanical Vibrations By: Singiresu S. Rao	6 7	293-317 355-380
UNIT-5	Continuous Systems	Transverse vibration of a spring or a cable, longitudinal vibration of bar or rod,Torsional vibration of a bar or rod, Lateral vibration of beams.	Mechanical Vibrations By: Singiresu S. Rao	8	398-421

COURSE COVERAGE SUMMARY

FOR

FLIGHT VEHICLE DESIGN

IV BTECH – I SEMESTER

(2022-2023)

(R18A2118) FLIGHT VEHICLE DESIGN
COURSE COVERAGESUMMARY

Unit No	Title of the Unit	Topics of the Unit	Name of The Text Book	Chapter No	Page No
I	Design Process Overview, Airfoil And Geometry Selection, Thrust To Weight Ratio, Wing Loading	Overview of aircraft design, Phases of aircraft design. Aircraft conceptual design process, Sizing from conceptual sketch, Empty weight & fuel fraction estimation, Mission profiles, Mission segment weight fractions. L/D estimation. Take-off weight estimation. Airfoil and geometry selection, Airfoil design, Design lift coefficient, Stall, Airfoil thickness ratio, Airfoil considerations. Wing geometry (aspect ratio, wing sweep, tapper ratio and wing vertical location, wing tip shapes. Tail geometry and arrangements. Thrust to weight ratio & Wing loading- statistical estimation, thrust matching. Wing loading (for take-off, instantaneous/sustained turn rate, loiterer endurance, cruise range).	**Aircraft Design: A Conceptual Approach** by Daniel P. Raymer	1,2,3,4, 5	1-100
II	Initial sizing & configuration layout	Sizing with fixed engine and with rubber engine. Refined sizing equations/ methods. Geometry sizing of fuselage, Wing, Tail, Control surfaces. Development of configuration lay out from conceptual sketch. The inboard profile drawing, Wetted area, Volume distribution and fuel volume plots, Lofting- definition, significance and methods, flat wrap lofting. Special consideration in configuration lay out. Isobar tailoring Sears-Haack volume distribution, structural load paths. Radar, IR, visual detect ability, aural signature considerations.	**Aircraft Design: A Conceptual Approach** by Daniel P. Raymer	6,7,	101-152
III	Crew station,passengers &payload, landing gear &subsystems, Structures, weight & balance	Fuselage design- crew station, passenger compartment, cargo provisions, weapons carriage, gun installation, Landing gear arrangements, guidelines for lay out. Shock absorbers – types, sizing, stroke determination, gear load factors. Gear retraction geometry. Aircraft subsystems, significance to configuration lay out. Airworthiness requirements - loads, safety margins, material properties, methods of estimation- construction, operation, maintenance, training- procedures, Aircraft materialsmechanical properties- design data- allowable, allowable bases. Failure theory. Flight loadsatmospheric, maneuver- construction of flight envelope. Wing loads, Empennage loads, Fuselage loads.	**Aircraft Design: A Conceptual Approach** by Daniel P. Raymer;	9,11	181-191, 229-252,

IV	Performance and constraint analysis refined sizing & trade studies	The aircraft operating envelope. Take off analysis, Balanced field length Landing analysis. Fighter performance measures of merit. Effects of wind on aircraft performance. Initial technical report of baseline design analysis and evaluation. Refined baseline design and report of specifications. Elements of life cycle cost, cost estimating method, RDT&E and production costs, operation and maintenance costs, fuel and oil costs, crew salaries Refined conceptual sizing methods. Sizing matrix plot and carpet plot. Trade studies - design trades, requirement trades, growth sensitivities. Measures of merit Determination of final baseline design configuration, preparation of type specification report	**Aircraft Design: A Conceptual Approach** by Daniel P. Raymer	17	455-491
V	Stability, control & handling qualities	Longitudinal static stability and control,aerodynamic center estimation, wing and tail lift and elevator, Estimation of wing, fuselage -and nacelle pitching moment, thrust effect, trim analysis, take-off rotation,velocity stability, Lateral & directional stability and control, lateral-directional derivatives, aircraft dynamic characteristics, steady roll, pull up, inertia coupling, Introduction to handling qualities(Cooper harper rating scale), Spin recovery.	**Aircraft Design: A Conceptual Approach** by Daniel P. Raymer	16	411-449