DETAILED SYLLABI

FOR

B. TECH (MINORS)
IN
MECHANICAL ENGINEERING

(SEMESTER III)

2023 SCHEME

(AUTONOMOUS)

MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University)
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B.Tech MINORS

Semester	BASKET I Supply Chain and Logistics				BASKET II Unmanned Aerial Vehicle (UAV)				BASKET III Computational Design Engineering			
	Course code	Course Name	L-T-P-J	Credits	Course code	Course Name	L-T-P-J	Credits	Course code	Course Name	L-T-P-J	Credits
S3	23MEL2MA	Supply chain and Logistics Management	3-0-0-0	3	23MEL2MC	Introduction to Unmanned Aerial Vehicles (UAV)	2-1-0-0	3	23MEL2ME	Computer Aided Design	2-0-1-0	3
S4	23MEL2MB	Emerging Technologies in SCM	2-1-0-0	3	23MEL2MD	Basics elements of UAV system	2-1-0-0	3	23MEL2MF	Finite Element Method	2-0-1-0	3
S5	23MEL3MA	Green Logistics and operations management	2-1-0-0	3	23MEL3MC	Design and Simulation of UAV	2-1-0-0	3	23MEL3ME	Computational Mechanics	2-1-0-0	3
S6	23MEL3MB	Digital Manufacturing Transformation	2-1-0-0	3	23MEL3MD	Fabrication and Testing of UAV	2-1-0-0	3	23MEL3MF	Optimization Techniques	2-1-0-0	3
S7	23MEL4MA	Mini Project	0-0-6-0	3	23MEL4MA	Mini Project	0-0-6-0	3	23MEL4MA	Mini Project	0-0-6-0	3
S8	23MEL4MB	Mini Project	0-0-6-0	3	23MEL4MB	Mini Project	0-0-6-0	3	23MEL4MB	Mini Project	0-0-6-0	3

S3 MINORS

Course Code	Course Name	Category	L	T	P	J	Credit	Year of Introduction
23MEL2MA	Supply chain and Logistics Management	VAC	3	0	0	0	3	2023

i) COURSE OVERVIEW

This course introduces supply chain management concepts, the various planning associated with in the supply chain, the inventory and logistics associated with supply chain networks.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

	Course Outcomes	Learning Level
CO 1	Explain the concepts of fundamental supply chain management.	Understand
CO 2	Explain the supply chain planning and cost management.	Understand
CO 3	Explain the inventory control and layout planning in supply chain.	Understand
CO 4	Explain the Logistics and Distribution management in supply chain.	Understand

iii) SYLLABUS

Fundamentals of Supply Chain Management: Supply chain networks, Decision phases in s supply chain, Supply chain models. Supply chain planning: Supply chain strategies, Supply chain drivers and obstacles, Strategic Alliances and Outsourcing.

Supply chain performance measurement: Planning demand and supply, Demand forecasting in supply chain, Aggregate planning in supply chain, Strategic Cost Management in Supply Chain.

Inventory theory models: Inventory Management, Economic Order Quantity Models, Reorder Point Models and Multi-echelon. Inventory Systems, Decisions in a supply chain, Supply chain facility layout and capacity planning.

Logistics Management: warehousing, order processing, information handling and procurement. Materials management functions and control, MRP, multi-echelons. Distribution Management, Outbound logistics, Facility location, Overview of Vehicle Routing Problems, direct shipment, warehousing, cross-docking; push vs. pull systems.

Transportation decisions, market channel structure. Logistics Customer Service,

Modelling logistics systems, cost effective distribution strategies, Value of information in logistics, E- logistics, risk-pooling effect, Third party, and fourth party logistics.

iv) a) TEXTBOOKS

1. Sunil Chopra, Peter Meindl, Dharam Vir Kalra. “Supply Chain Management”, 7th Edition, Pearson Prentice Hall,2023
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Ravi Shankar,” Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies (“2022), 4th Edition by.

b) REFERENCES

1. David. Bloomberg, Stephen LeMay, Joe Hanna, "Logistics", Prentice Hall 2020

2. Christopher, M. "Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Services". London: Financial Times/Pitman.

v) COURSE PLAN

Module	Contents	Hours
I	**Basic General features of Supply chain:** Fundamentals of Supply Chain Management, Supply chain networks, Decision phases in s supply chain, Supply chain models. **Supply chain planning**: Supply chain strategies, Supply chain drivers and obstacles, Strategic Alliances and Outsourcing	**10**
II	**Supply chain performance measurement:** Performance Metrics. Planning demand and supply, Demand forecasting in supply chain, Aggregate planning in supply chain. **Strategic Cost Management in Supply Chain:** Volume leveraging and cross docking, global logistics and material positioning, global supplier development, target pricing, cost management enablers.	**9**
III	**Inventory theory models**: Inventory management, Economic Order Quantity Models, Reorder Point Models and Multi-echelon Inventory Systems, Decisions in a supply chain, Supply chain facility layout and capacity planning.	**8**
IV	**Logistics Management** - warehousing, order processing, information handling and procurement. Materials management functions and control, MRP, multi-echelons. **Distribution Management**- Outbound logistics, Facility location, Overview of Vehicle Routing Problems, direct shipment, warehousing, cross-docking; push vs. pull systems.	**10**
V	**Transportation decisions**: market channel structure. Logistics Customer Service, Modelling logistics systems, cost effective distribution strategies, Value of information in logistics, E- logistics, risk-pooling effect, Third party, and fourth party logistics.	**8**
	Total	**45**

vi) ASSESSMENT PATTERN

Continuous Assessment: End Semester Examination – 40 : 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100 marks**

vii) CONTINUOUS ASSESSMENT TEST

- No. of tests: 02
- Maximum Marks: 40
- Test Duration: 1 ½ hours
- Topics: 2 ½ modules

viii) END SEMESTER EXAMINATION

- Maximum Marks: 60
- Exam Duration: 3 hours

Course Code	Course Name	Category	L	T	P	J	Credit	Year of introduction
23MEL2MC	INTRODUCTION TO UNMANNED AERIAL VEHICLES	VAC	2	1	0	0	3	2023

i) COURSE OVERVIEW

This course provides a comprehensive introduction to Unmanned Aerial Vehicles (UAVs), commonly known as drones. It covers the fundamental principles of UAV technology, design, and applications. The course aims to equip students with the knowledge and skills needed to understand and engage with UAV technology in various fields.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO1	Explain the basis of UAV development, atmosphere and the aerodynamics of flight.	Understand
CO2	Apply the fundamental knowledge of atmosphere and aerodynamics to solve problems.	Apply
CO3	Explain the design aspects of UAV system, airframe configurations, sensors and regulatory details.	Understand
CO4	Explain the UAV deployment aspects, roles, future prospects and challenges.	Understand

iii) SYLLABUS

Introduction to UAV: Definition, history, difference between manned and unmanned aviation. Classification of Aircraft and propulsion systems. Drone/UAV flight, Merits and Demerits, Need of UAVs. Terminology, Maintenance, and Safety. Mission Definition and Planning. Standard atmosphere - Introduction. Wing nomenclature and types.

UAV Systems - characteristics and related terminology, Air Vehicle, Mission Planning and Control Station, Parts of UAV/drone system, Launch and Recovery Equipment, Payloads - types, Data Links, Ground Support Equipment. Classes of UAVs: Overview and examples of UAV Systems. The systemic basis of UAV.

Introduction to Aerodynamics: Basic Aerodynamics, Nomenclature and Types of wings, Lift and Drag, Angle of Attack, Mach number. Stability – Turning Flight – Stall. Aircraft Polar, The Boundary Layer, Flapping Wings, Total Air-Vehicle Drag. Rotary-wing Aerodynamics, Response to Air Turbulence.

Basic design of UAV Systems: Introduction to Design and Selection of the System - Conceptual Phase, Preliminary Design, Detail Design, Selection of the System, Aerodynamics and Airframe Configurations - Airframe Configurations. Design

Standards and Regulatory Aspects – Introduction. Types of sensor used to record data on flights. Trigonometry and its application to drone flight.

UAV Deployment: Introduction, Network-centric Operations (NCO), Teaming with Manned and Other Unmanned Systems. Future Prospects and Challenges: Introduction, Operation in Civilian Airspace, Power-plant Development, Developments in Airframe Configurations, Autonomy and Artificial Intelligence, Improvement in Communication Systems.

iv) a) TEXTBOOKS

1. Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, Introduction to Unmanned Aircraft Systems, CRC Press, Taylor and Francis, 2012.
2. Paul Gerin Fahlstrom, Thomas James Gleason, Introduction to UAV Systems, Fourth Edition, Wiley Publications, 2012.
3. Reg Austin, Unmanned Aircraft Systems, Wiley Publications, 2010.
4. Anderson, Fundamentals of Aerodynamics, McGraw-Hill, 2010.

b) REFERENCES

1. Kimon P. Valavanis, George J. Vachtsevanos, Handbook of Unmanned Aerial Vehicles, 2015.
2. A.C. Kermode, Mechanics of flight, Prentice Hall, 2007.

v) COURSE PLAN

Module	Contents	No. of hours
I	Introduction to UAV: Definition, history, difference between manned and unmanned aviation. Classification of Aircraft and propulsion systems. Overcoming the Manned Pilot Bias. Drone/UAV flight, Merits and Demerits, Need of UAVs - research, industrial, surveying, emergency response, risk management. Terminology, Maintenance, and Safety. Mission Definition and Planning. Standard atmosphere - different layers, pressure, temperature and density variations in the atmosphere. Wing nomenclature and types.	9
II	UAV Systems - characteristics and related terminology, Air Vehicle, Mission Planning and Control Station, Parts of UAV/drone system, Launch and Recovery Equipment, Payloads - types, Data Links, Ground Support Equipment. Classes of UAVs: Overview and examples of UAV Systems, Very Small, Small, Medium, Large and Expendable UAVs, Classification by Range and Endurance, size constraints. The systemic basis of UAV.	8
III	Introduction to Aerodynamics: Basic Aerodynamics, Lift and Drag, Types of drag, Angle of Attack, Mach number, Reynolds number and its calculations. Stability, Stall and stages of flight. Aircraft Polar, The Boundary Layer, Flapping Wings, Total Air-Vehicle Drag. Role of	10

	propellers in unmanned aerial systems, Rotary-wing Aerodynamics, Response to air turbulence. Introduction to propulsion performance for specific UAS applications.	
IV	Introduction to Design and Selection of the UAV System - Conceptual Phase, Preliminary Design, Detail Design, Selection of the System, Material selection and Airframe Configurations. Design Standards and Regulatory Aspects – Introduction. Types of sensor used to record data on flights - optical cameras, LiDAR, thermal. Converting requirements into specifications. Selection of Batteries based on requirement.	**10**
V	UAV Deployment: Introduction, Network-centric Operations (NCO), Teaming with Manned and Other Unmanned Systems. Naval Roles, Army Roles, Air Force Roles, Civilian, Paramilitary and Commercial Roles. Virtual Test Environments for UAVs - Basic aspects. Future Prospects and Challenges: Introduction, Operation in Civilian Airspace, Developments in Airframe Configurations, Autonomy and Artificial Intelligence, Improvement in Communication Systems.	**8**
	Total	**45**

vi) ASSESSMENT PATTERN

Continuous Assessment: End Semester Examination – 40: 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100marks**

vii) CONTINUOUS ASSESSMENT TEST

- No. of tests: 02
- Maximum Marks: 30
- Test Duration: 1 ½ hours
- Topics: 2 ½ modules

viii) END SEMESTER EXAMINATION

- Maximum Marks: 60
- Exam Duration: 3 hours

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
23MEL2ME	Computer Aided Design	VAC	2	0	1	3	2023

i) COURSE OVERVIEW:

The course explores the principles and techniques behind generating, manipulating and rendering visual images using algorithms and software (CATIA/Autodesk Inventor). This course intends to introduce students to use of computers in the phases of product design viz. conceptualization, geometric modelling and graphical representation.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain the fundamental ideas of Computer Aided Design methods and procedures	Understand
CO 2	Explain the fundamentals of solid modelling	Understand
CO 3	Construct part drawings and sectional views using CAD software	Apply
CO 4	Construct 3D and Assembly drawing using CAD software	Apply

iii) SYLLABUS

Introduction to CAD/CAM , Concept of Coordinate Systems and algorithms. Curves and Surfaces, Parametric representation of lines, Parametric representation of circle, Ellipse, parabola and hyperbola and Synthetic Curves. Mathematical representation of solids and Geometric transformations. Engineering Drawing, Detailing, Part modeling and assembly modelling.

iv) a) TEXTBOOKS

1. M.P. Groover, E.M. Zimmers, Jr.CAD/CAM; Computer Aided Design and Manufacturing, Prentice Hall of India, 2014

2. D. F. Rogers and J. A. Adams, Mathematical Elements in Computer Graphics, McGraw-Hill,2017

b) REFERENCES

1. Chris Mcmahon and Jimmie Browne - CAD/CAM – Principle Practice and Manufacturing Management, Addision Wesley England,1998
2. Donald Hearn, M. Pauline Baker and Warren Carithers, Computer Graphics with open GL, Pearson ducation,2001
3. Grigore Burdea, Philippe Coiffet, Virtual Reality Technology, John Wiley and sons,2003

v) COURSE PLAN

Module	Contents	No. of hours
I	Overview of CAD: Definition, History, and Importance, CAD vs. Manual Drafting: Advantages and Applications. Introduction to CAD Software: AutoCAD, SolidWorks, and others, Basic CAD Terminology, Sketches, Drawings, Model, Graphics exchange standards and Database management systems. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System. Line and Curve generation algorithm: DDA, Bresenham's algorithms.	8
II	Curves and Surfaces: Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of conic sections. Various types of surfaces along with their typical applications 2D Drafting fundamentals: principles, views, layouts, dimensioning, annotations, layers and object properties.	9
III	Geometric Transformations: Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D. Advanced 2D drafting techniques: shapes, patterns, editing and modifying tools. Hatching and symbol libraries.	10
IV	Part Modeling: Standards, Formats, Unit Systems, Comparison of wireframe, surface and solid models, Projection Views, Isometric Representations, Cross Sections, Exploded Views, Bills of Materials, Geometric Patterns, Sweep and Blend Operations, Creation of high end part models.	8
V	Assembly Modeling: Iterative Design Concepts, Parent-child relationships, Feature and Group Operations, Standard Components, Flexible Geometry, Creation of assembly models.	8
	Total hours	**45**

vi) ASSESSMENT PATTERN

Continuous Assessment : End Semester Examination – 60 : 40

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
	:	
	:	
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100 marks**

vii) CONTINUOUS ASSESSMENT TEST

- No. of tests: 02
- Maximum Marks: 30
- Test Duration: 1 ½ hours
- Topics: 2 ½ modules

viii) END SEMESTER EXAMINATION

- Maximum Marks: 60
- Exam Duration: 3 hours