Aniversity of Mumbai



No. UG/38 of 2020-21

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office circular No.UG/129 of 2017-18, dated 31st July, 2017 relating to the revised syllabus as per the (CBCS) for the B. Sc. Aeronautics – Mechanical (Sem. I to VI).

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in Aviation at its online meeting held on 11th May, 2020 <u>vide</u> item No. 1 and subsequently made by the Board of Deans at its meeting held on 26th June, 2020 <u>vide</u> item No. 13 (7) have been accepted by the Academic Council at its meeting held on 23rd July, 2020 <u>vide</u> item No. 4.72 and that in accordance therewith, the revised syllabus as per the (CBCS) of B.Sc. Aeronautics (Mechanical) (Sem. I to VI) has been brought into force with effect from the academic year 2020 -21 accordingly. (The same is available on the University's website <u>www.mu.ac.in</u>).

MUMBAI – 400 032

(Dr. Vinod Patil) I/c REGISTRAR

To

The Principals of the Affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.72/23/07/2020

No. UG/38 -A of 2020-21 MUMBAI-400 032 Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Ad-hoc Board of Studies in Aviation,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Co-ordinator, University Computerization Centre,

1Th November, 2020



AC	
Item No.	



Cover Page

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	AC Item No				
	UNIVERSITY OF MUMBAI				
	Syllabus for Approval				
Sr. No.	Heading	Particulars			
1	Title of the Course	B.Sc. Aeronautics (Mechanical)			
2	Eligibility for Admission	10+2 with Physics, Mathematic & English			
3	Passing Marks	45% for General Category 40% for Reserve Category			
4	Ordinances / Regulations (if any)	O-5962 & O-5963			
5	No. of Years / Semesters	3 years/ 6 semisters			
6	Level	U.G . (Strike out which is not applicable)			
7	Pattern	Semester (Strike out which is not applicable)			
8	Status	Revised (Strike out which is not applicable)			
9	To be implemented from Academic Year	From Academic Year 2020 - 2021			

Date:

Signature :

Name of BOS Chairman / Dean :

Wg.Cdr.S.C.Mehta/ Dr.Majumdar

UNIVERSITY OF MUMBAI SYLLABUS (Revised) for the F.Y.B.Sc. Program: B.Sc. (Aeronautics) (Mechanical)

(Choice Based and Credit System with effect from the academic year 2020-2021)

Evaluation scheme							
Semester	Course Code	Course Title	Credits	Lecture one hour duration	Practical code	Credits	Lecture one hour duration
I	USARM 101	BASIC AERODYNAMICS	3	70	USARM 1P1	2	50
	USARM 102	WORKSHOP TECHNOLOGY	3	70	USARM 1P2	2	50
	USARM 103	ELECTRICAL FUNDAMENTALS (I)	3	70	USARM 1P3	2	50
	USARM 104	ENGINEERING DRAWING	2	50			
	USARM 105	HUMAN FACTORS / COMMUNICATION SKILL	3	70			
	USARM 1P1	BASIC AERODYNAMICS & WORKSHOP TECHNOLOGY- PRACTICAL	2				
	USARM 1P2	ELECTRICAL FUNDAMENTALS- PRACTICAL	2				
	USARM 1P3	ENGINEERING DRAWING-PRACTICAL	2				
			20				

Evaluation scheme					
Theory	Internal		Semester end examination	Total	Duration of
Theory		Marks	marks	Marks	examination
USARM 101		25	75	100	2.5 HOURS
USARM 102		25	75	100	2.5 HOURS
USARM 103		25	75	100	2.5 HOURS
USARM 104		25	75	100	2.5 HOURS
USARM 105		25	75	100	2.5 HOURS
UCADM 1D1	Unit 1	-	50	100	2.5 HOURS
USARM IPI	Unit 2	-	50	100	2.5 HOURS
USARM 1P2		-	50	50	2.5 HOURS
USARM 1P3		-	50	50	2.5 HOURS
				700	

Course Code	SUBJECT SEMESTER I (Mechanical) Theory	Credits
USARM 101	BASICAERODYNAMICS	Credits 3 Lectures 70
 Unit I -Aerodynamics : a) Physics of the Atmosphere International Standard Atmosphere (ISA), application to aerodynamics. Aerodynamics : b) Aerodynamics Airflow around a body, Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation. The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, center of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant, Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall, Aerofoil contamination including ice, snow, frost. 		25 L ectures
Unit II -Th Relationshi flights, per envelope at	25 Lectures	
Unit III -Flight Stability and Dynamics: Introduction to aircraft, major aircraft components, aircraft systems and their functions, reference lines, station and zone identification systems International Standard Atmosphere (ISA), application to aerodynamics. Longitudinal, lateral and directional stability (active and passive).		20 Lectures
Reference 1) Mechan 2) Aviation 3) Aviation 4) Basic A	Book : hics of Flight AC Kermode n Maint. Technician Hand Book-General -9A FAA on Maint. Technician Hand Book-Airframe -15A FAA herodynamics EASA Module 08 AIRCRAFT TECH BOOK CO	

Course Code	SUBJECT SEMESTER I (Mechanical) Theory	Credits
USARM 102	WORKSHOPTECHNOLOGY	Credits 3 Lectures 70
Unit I - Basics of V including p especially (taken in the hazards inc control of t Standards of Standards, for bolt hol Schedule o twist and w parts, Type composite	Vorkshop Practice Aspects of safe working practices recautions to be taken up while working with electricity, gases Dxygen, Acetylene, oils and chemicals. Remedial action to be e event of a fire or another accident with one or more of these luding knowledge on extinguishing agents. Care of tools, ools and use of workshop materials. Limits, fits and tolerances, of workmanship, Calibration of tools and equipment, Calibration Common hand tool types, Common power tool types, Drill sizes es, classes of fits, Common system of fits and clearances, if fits and clearances for aircraft and engines; Limits for bow, rear, Standard methods for checking shafts, bearings and other s of composite, manufacturing of composite and working with i.e. machining and joining	25 Lectures
Unit II Basic Airo Screw threa tolerances to bolts, studs marking of anchor, stat types and u spring wash release fast specification	craft Hardware ads, screw nomenclature; thread forms. Dimensions and for standard threads used in aircraft, measuring screw threads; and screws, Bolt types: specification, identification and aircraft bolts, International standards. Nuts: self-locking, ndard types; Machine screws: aircraft specifications; Studs: ses, insertion and removal; Self tapping screws dowels, Tab and hers, locking plates, split pins, pal-nuts, wire locking, Quick eners, Keys, circlips, cotter pins, Types of solid and blind rivets: ons and Identification, heat treatment.	25 Lectures
Unit III Locking de palnuts, wi	evices Tab and spring washers, locking plates, split pins, re locking, Quickrelease fasteners, keys, circlips, cotter pins.	20 Lectures

Aircraft rivets Types of solid and blind rivets: specifications and identification, heat treatment. Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.	
Reference Book : 1) Airframe & Power plant Mechanics (General Handbook EA-AC 65-9A) 2) Shop Theory J. A Enderson & Tatro 3) Aviation Maint. Technician Handbook-Airframe – 15A (Vol-I & II) - -FAA H- 8083-31	

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Course Code	SUBJECT SEMESTER I (Mechanical) Theory	Credits
USARM 103	ELECTRICAL FUNDAMENTALS (1)	Credits 3 Lectures 70
Unit I: Aspects of working w charges; E Coulomb's vacuum. Electrical affecting t resistance, Generation methods: I motion. Electrical electrical s Avionic G general tes	Static Electricity and Conduction: Static Electricity and Conduction: Safe working practices including precautions to take when with electricity Static electricity and distribution of electrostatic lectrostatic laws of attraction and repulsion; Units of charge, a Law; Conduction of electricity in solids, liquids, gases and a Terminology The following terms, their units and factors hem: potential difference, electromotive force, voltage, current, conductance, charge, conventional current flow, electron flow. on of Electricity Production of electricity by the following ight, heat, friction, pressure, chemical action, magnetism and general test equipment Operation, function and use of general test equipment's eneral Test Equipment's - Operation, function and use of avionic at equipment.	20 Lectures
Unit II: D Construct lead acid c series and Constructi cells. DC Circu	C Sources of Electricity ion and basic chemical action of: primary cells, secondary cells, cells, nickel cadmium cells, other alkaline cells; Cells connected in parallel; Internal resistance and its effect on a battery; on, materials and operation of thermocouples; Operation of photo- its Ohms Law, Kirchhoff's Voltage and Current Laws;	25 Lectures

Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply. Magnetism Magnetism Theory of magnetism; Properties of a magnet Action of a magnet suspended in the Earth's magnetic field; Magnetisation and demagnetisation; Magnetic shielding; Various types of magnetic material; Electromagnets construction and principles of operation; Hand clasp rules to determine: magnetic field around current carrying conductor. Magneto motive force, field strength, magnetic flux density, permeability, hysteresis loop, retentively, coercive force reluctance, saturation point, eddy currents; Precautions for care and storage of magnets.	
Unit III : Resistive (R), Capacitive (C) and Inductive (L) Circuits Inductance/Inductor Faraday's Law; Action of inducing a voltage in a conductor moving in a magnetic field; Induction principles; Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductor turns; Mutual induction; The effect the rate of change of primary current and mutual inductance has on induced voltage; Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other; Lenz's Law and polarity determining rules; Back emf, self induction; Saturation point; Principle uses of inductors; Resistance/Resistor Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge; Power Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy, Capacitance/Capacitor	25 Lectures

Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors. Phase relationship of voltage and current in L, C and R circuits, parallel, series and series parallel; Power dissipation in L, C and R circuits; Impedance, phase angle, power factor and current calculations; True power, apparent power and reactive

Reference Book :

- 1. Electrical technology by B L Theraja
- 2. Aircraft Electricity and Electronic by Eismen
- 3. Examples in electrical Calculation by Admirality

Course Code	SUBJECT SEMESTER (Mechanical) Theory	Credits
USARM 104	ENGINEERING DRAWING	Credits 2 Lectures 50
Unit I – Introducti and their informatic symbols, Types of I and its po compariso	on of Engineering Drawing, Introduction to drawing instrument uses, Drawing sheet layout and sizes, Identifying title block on Diagrams and Standards Drawing types and diagrams, their dimensions, tolerances and projections; lines and their applications, Dimensioning terminology, Quadrant sitions, First angle and third angle projection method and their on	15 Lectures
Unit II – Ellipse, pa Orthogra view by fi sectional Isometric isometric	Engineering Curves arabola and hyperbola only focus-diretrix method aphic ProjectionOrthographic Projection of given pictorial arst angle & Third angle method of projection, Types of sections, orthographic projection (only full sectional orthographic view) e View Introduction of isometric view with example of cube, axes, scale, isometric projection and isometric view, drawing view of simple solids and its dimension in	20 Lectures
Unit III – Sketches Free hand headed nu computer Associatio standards	Wiring diagrams and schematic diagrams.& Free Hand sketching – FV and TV of standard machine parts - Hexagonal at and bolt, foundation bolt, Microfilm, microfiche and sed presentations; Specification 100 of the Air Transport on (ATA) of America; Aeronautical and other applicable including ISO, AN, MS, NAS and MIL	15 Lectures
Referenc 1) Engine 2) Machir 3) Airfran	e Book : ering Drawing N D Bhat ne Drawing AC Parkinsons ne & Power plant Mechanics (General Handbook EA-AC 65-9A)	

Course Code	SUBJECT SEMESTER I (Mechanical) Theory	Credits
USARM 105	HUMAN FACTORS/COMMUNICATION SKILL	Credits 3 Lectures 70
 Unit I 1) Genera attribut 2) Human process physica 3) Social I and de- Manage 4) Factors work re underlo abuse. 	al - The need to take human factors into account; Incidents able to human factors/human error; 'Murphy's' law. Performance and Limitations Vision; Hearing; Information sing; Attention and perception; Memory; Claustrophobia and al access. Psychology Responsibility: individual and group Motivation motivation; Peer pressure; 'Culture' issues; Team working; ement, supervision and leadership Affecting Performance Fitness/health; Stress: domestic and elated; Time pressure and deadlines; Workload: overload and bad; Sleep and fatigue, shiftwork; Alcohol, medication, drug	25 Lectures
 Unit II - 1) Physica tempera 2) b)Taska 3) Complete 4) C) Conrecordi 5) d) Hummainten managi 6) e) Haza 7) Dealing 	al Environment Noise and fumes; Illumination; Climate and ature; Motion and vibration; Working environment. s Physical work; Repetitive tasks; Visual inspection; ex systems. munication Within and between teams; Work logging and ng; Keeping up to date, currency; Dissemination of information. nan Error Error models and theories; Types of error in nance tasks; Implications of errors (i.e accidents) Avoiding and ng errors. ards in the Workplace Recognising and avoiding hazards; g with emergencies.	25 Lectures
Unit III– 1) Readin Abstracting vocabulary conversation 2) Profess Profession Speaking	g, Comprehension skills and vocabulary development : g and summarizing skills, Concepts of functional and reading , Importance of vocabulary and its enhancement, Developing effective onal skills, Oral and written expression of ideas. ional skill al skill development, writing: – letter writing, report writing, & listening: – discussion, debates. Seven C's of effective	20 L ectures

communication 3)Human rights: Human rights constituents with special reference to Fundamental Rights in India	
Reference Book :-	
1) Human Factors Training Manual ICAO Doc 9683	
2) EASA Module-09 Human Factors AIRCRAFT TECH BOOK CO.	
3) Human Rights and communication skills by Basant Rani	

Course Code	SUBJECT SEMESTER I (Mechanical) Practicals	Credits
USARM 1P1	BASIC AERODYNAMICS & WORKSHOP TECHNOLOGY	Credits 2 Lectures 50
NOTE following Unit I (Students 7 Practical's 1) To unde drag, effec 2) Identify 3) Identifie 4) Identifie 5) Identifie 6) Identifie engine atta 7) Examin 8) Visual	 E: Students will have to perform minimum 16 practical's from list of Practical's: {From Unit I minimum 7 Practical's & from Unit II minimum 7 Practical's } BASIC AERODYNAMICS will have to perform minimum 7 practical's from following list of s) erstand the shape of airfoils and wing and how they affect lift and et of boundary layer on flow around the body. ring aircraft reference lines, station and zone numbers cation of major structural members of fixed wing aircraft. cation of type of Fuselage and method of pressure sealing. cation of components of flight control surfaces and landing gear and achment ations of the flight control, checking its movement and greasing Checks on spoilars position. 	25 lectures
9) Assessr 10) Identif	nent of damage on fuselage exterior skin.	

Unit II WORKSHOP TECHNOLOGY	
 (Students will have to perform minimum 7 practical's from following list of Practical's) 1) Demonstration of safety precautions while using fluids, gases, electricity, fire and chemicals & identification of different type of Fire & Fire Extinguishers. 2) Demonstration of hand tools and equipment and their correct use. 3) 3)Demonstration of correct use of measuring equipment (tools) like micrometers, Vernier caliper, 4) Demonstration of correct use of Dial Indicator, bevel protector, combination set etc. 5) Demonstration and use of torque wrench for given torque value. 6) Demonstration of the use of calipers, feeler, fillet, radius limit, telescopic gauge for inspection of one simple assembly. 7) Use hand & power tools to drilling (example: rivet holes drilling). 8) Demonstration of the use and cotter pin licking practice. 10) Demonstration of the use and cotter pin licking practice. 11) Demonstration of the wire and cotter pin licking practice. 	25 lectures

Course Code	SUBJECT SEMESTER (Mechanical) Practicals	Credits
USARM 1P2	ELECTRICAL FUNDAMENTALS (1)	Credits 2 Lectures 50
 <u>NOTE</u>: following 1) To veri 2) To desi circuit 3) Identify using I 4) Demore measure 5) To den circuit 6) To stuce 7) To iden its value 8) Connece measure 9) To Den 10) To den its value 8) Connece measure 9) To Den 10) To den its value 8) Connece 	Students will have to perform minimum 12 practicals from list of Practicals: fy the ohm law & Kirchhoff law using resistive network. gn electrical circuit using electrical appliances like fuse, switch , breaker, socket, bulb, contactor and verify its operation y various types of resister on the basis of colour code and validate DMM/AMM. stration of the resister in series/parallel /in combination and e the value of resister through AMM/DMM. nonstrate the use of potentiometer and rheostat by using electrical ly operation of Wheatstone bridge. ntify the various type of capacitor using colour code and validate e by using LCR Q meter. ttion of the capacitor in series/parallel /in combination and e the value of Capacitor through capacitor meter. nonstrate the process of Magnetization and demagnetization; demonstrate the faradays law of electromagnetic Induction. est the armature in Growler and through multimeter / test lamp. neasure the high resistance by megger, and extension of range of ter ammeter and ohm meter. rking of Relays and solenoids tion of battery cells in series and parallel	50 lectures

Course Code	SUBJECT SEMESTER (Mechanical) Practicals	Credits
USARA 1P3	ENGINEERING DRAWING	Credits 2 Lectures 50
NOTE: following 1. Types o 2. Enginee 3. Projecti 4. Projecti 5. Projecti 6. Projecti 7. Projecti 8. Develop 9. Orthogr 10. Section 11. Isomet 12. Isomet 13. Free h shafts, key 14. Free h riveted joi	Students will have to perform minimum 12 practicals from list of Practicals: f lines, lettering, dimensioning of simple orthographic view ering curves (minimum 3 problems) on of points (all possible positions) on of lines (minimum 3 problems) on of planes (minimum 3 problems) on of solids (minimum 3 problems) on of section of solids (minimum 3 problems) on of section of solids (minimum 3 problems) on ef section (2 Problems) nal orthographic projection (2 Problems) ric views (simple solid 2 problem) ric views (machine component 2 problem) and sketches (Hexagonal headed nut and bolt, foundation bolt, rs, couplings) and sketches (springs, screws, threaded forms, welded joints, nts)	50 lectures

	Evaluation scheme						
Semester	Course Code	Course Title	Credits	Lecture one hour duration	Practical code	Credit s	Lecture one hour duratio n
11	USARM 201	ELECTRICAL FUNDAMENTALS (II)	3	70	USARM 2P1	2	50
	USARM 202	ELECTRONIC FUNDAMENTALS	3	70	USARM 2P2	2	50
	USARM 203	MAINTENANCE PRACTICES (I)	3	70	USARM 2P3	2	50
	USARM 204	AIRCRAFT STRUCTURE	3	70			
	USARM 205	ENVIRONMENTAL STUDIES	2	50			
	USARM 2P1	ELECTRICAL FUNDAMENTALS (II)	2				
	USARM 2P2	ELECTRONIC FUNDAMENTALS	2				
	USARM 2P3	AIRCRAFT STRUCTURE & MAINTENANCE PRACTICES (I)	2				
2			20				

Evaluation scheme					
Theor	у	Internal Marks	Semester end examination marks	Total Marks	Duration of examination
USARM 201		25	75	100	2.5 HOURS
USARM 202		25	75	100	2.5 HOURS
USARM 203		25	75	100	2.5 HOURS
USARM 204		25	75	100	2.5 HOURS
USARM 205		25	75	100	2.5 HOURS
USARM 2P1		-	50	50	2.5 HOURS
USARM 2P2		-	50	50	2.5 HOURS
LICADM 2D2	Unit 1	_	50	100	2.5 HOURS
USARM 2P3	Unit 2	_	50	100	2.5 HOURS
				700	

SEMESTER II MECHANICAL THEORY

Course Code	SUBJECT SEMESTER II (Mechanical) Theory	Credits
USARM 201	ELECTRICAL FUNDAMENTALS (II)	Credits 3 Lectures 70
Unit I - a) DC Moto Construction and factors a generators; Operation of direction of Series woun construction b) AC Theo Instantaneou values and c power Trian	or/Generator Theory Basic motor and generator theory; in and purpose of components in DC generator; Operation of, affecting output and direction of current flow in DC f, and factors affecting output power, torque, speed and rotation of DC motors; d, shunt wound and compound motors; Starter Generator ry Sinusoidal waveform: phase, period, frequency, cycle; as, average, root mean square, peak, peak to peak current alculations of these values, in relation to voltage, current and agular/Square waves; Single/3 phase principles.	25 L ectures
Unit II - i) Resistive (relationship and series pa phase angle, power and re ii) Transformer action under Power transf Calculation Primary and Auto transfo	(R), Capacitive (C) and Inductive (L) Circuits -Phase of voltage and current in L, C and R circuits, parallel, series arallel; Power dissipation in L, C and R circuits; Impedance, power factor and current calculations; True power, apparent eactive power calculations. mers - Transformer construction principles and operation; losses and methods for overcoming them; Transformer load and no-load conditions; fer, efficiency, polarity markings; of line and phase voltages and currents; of power in a three phase system; Secondary current, voltage, turns ratio, power, efficiency; ormers.	25 Lectures
Unit III - a) Filters - C pass, high pa	Operation, application and uses of the following filters: low ass, band pass, band stop.	20 L ectures

b) AC Generators - Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators.

c) AC Motors ---- Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.

Reference Book :-

1) Aircraft Electrical System --- E.H.J.Pallett

2)Aircraft Electricity & Electronics ---- Thomas K Eismin

3) Aviation Maint. Technician Hand Book-General -9A ---- FAA

Course Code	SUBJECT SEMESTER II (Mechanical) Theory	Credits		
USARM 202	ELECTRONIC FUNDAMENTALS	Credits 3 Lectures 70		
Unit I - i) Semiconductors Diodes				
(a) - Diode symbols; Diode characteristics and properties; Diodes in series and parallel; Main characteristics and use of silicon controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes; Functional testing of diodes.				
Materials, e materials: e characters; across a PN conditions;	electron configuration, electrical properties; P and N type ffects of impurities on conduction, majority and minority PN junction in a semiconductor, development of a potential junction in unbiased, forward biased and reverse biased	25 Lectures		
Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers; Detailed operation and characteristics of the following devices: silicon controlled rectifier (thyristor), light emitting diode, Shottky diode, photo conductive diode, varistor diode, rectifier diodes, Zener diode.				
Unit II - a) Transist orientation; operation o configuratio	fors Transistor symbols; Component description and Transistor characteristics and properties. Construction and f PNP and NPN transistors; Base, collector and emitter ons;			
Testing of t uses. Appli- including: t principles:	ransistors Basic appreciation of other transistor types and their cation of transistors: classes of amplifier (A, B, C);Simple circuits bias, decoupling, feedback and stabilisation; Multistage circuit cascades, push-pull, oscillators, multi vibrators, flip-flop circuits.	25 Lectures		
b) Integrated Circuits Description and operation of logic circuits and linear circuits/operational amplifiers.				
Description	and operation of logic circuits and linear circuits; Introduction to			

 operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback. c) Printed Circuit Boards -Description and use of printed circuit boards. 	
Unit III - a) Servomechanisms Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers; Principles of operation and use of the following synchro system components/ features: resolvers, differential, control and torque, transformers, inductance and capacitance transmitters. (b) Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, deadb and; Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, Servomechanism defects, reversal of synchro leads, hunting.	20 Lectures
Reference Book :- 1) Aircraft Radio System J. Powell 2) Electronic Communication System — Coorner Konnedy	
 2) Electronic Communication System George Kennedy 3) Digital Principles and Applications by DONALD P. LEACH, ALBERTPAUL ALVINO,GOUTAM SAHA 	

Course Code	SUBJECT SEMESTER II (Mechanical) Theory	Credits
USARM 203	MAINTENANCE PRACTICES (1)	Credits 3 Lectures 70
Unit I – a) Tools and use of electrical g General T Clearances and clearan Limits for Types of ri Standard u	Common hand tool types; Common power tool types; Operation precision measuring tools; Operation, function and use of general test equipment; Operation, function and use Avionic rest Equipment – Lubrication equipment and methods. Fits and b Drill sizes for bolt holes, classes of fits; Common system of fits nees; Schedule of fits and clearances for aircraft and engines; bow, twist and wear Aircraft Plumbing, Mechanism & Linkages agid and flexible pipes and their connectors used in aircraft. nions for aircraft hydraulic, fuel, oil, pneumatic system pipes.	20 L ectures
Unit II - Types of sy reduction a gears, mes cables; end cable syste systems. P bearings an	prings, materials, Gear types and their application; Gear ratios, and multiplication gear systems, driven and driving gears, idler h Patterns; Belts and pulleys, chains and sprockets Types of l fittings, turnbuckles and compensation devices; Pulleys and em components; Bowden cables; Aircraft flexible control urpose of Bearings, loads, material, and construction; types of nd their application,	25 L ectures
Unit III – Inspection methods an c) Bonding metallic - I	 Different methods of welding, brazing and soldering. of welded, brazed and soldered joints. Adhesive bonding nd inspection of bonded joints. g methods and inspection of bonded joints. Composite and non- Bonding practices; Environmental conditions Inspection methods 	25 L ectures
Reference 1) Aviation 2) EASA M 3) Civil Ai	Book :- n Maint.Technician Hand Book-General -9A FAA Module-07A Maintenance Practices AIRCRAFT TECH BOOK CO rcraft Inspection Procedures (CAP 459) CAIP I Basic	

Course Code	SUBJECT SEMESTER II (Mechanical) Theory	Credits
USARM 204	AIRCRAFT STRUCTURE	Credits 3 Lectures 70
Unit I - a) General Airworthin primary, se concepts; 2 Stress, stra fatigue; Dr System ins Aircraft bo	I Concepts ness requirements for structural strength; Structural classification, econdary and tertiary; Fail safe, safe life, damage tolerance Zonal and station identification systems; in, bending, compression, shear, torsion, tension, hoop stress, rains and ventilation provisions; stallation provisions; Lightning strike protection provision. onding	20 L ectures
Unit II - Fa Structure ; Constructi longerons, reinforcem empennag	amiliarization of Fuselage types ; Familiarization of Wing Familiarization of Control Surface on methods of: stressed skin fuselage, formers, stringers, bulkheads, frames, doublers, struts, ties, beams, floor structures, nent, methods of skinning, anti-corrosive protection, wing, e and engine attachments;	25 Lectures
Unit III - Structure a Methods o Surface cle Airframe s	assembly techniques: riveting, bolting, bonding f surface protection, such as chromating, anodising, painting; eaning. symmetry: methods of alignment and symmetry checks.	25 Lectures
Reference 1) FAA H- 2) FAA H- 3) Civil Ai)	

Course Code	SUBJECT SEMESTER II (Mechanical) Theory	Credits
USARM 205	ENVIRONMENTAL STUDIES	Credits 2 Lectures 50
Unit I–En Environme ecological in sustaina	vironmental concepts : ent: definition and composition, atmosphere, biosphere, system and ecology, food chain, exploitation of natural resources ble manner, Global warming, Acid rain.	15 Lectures
Unit II–D What is d disaster, d classificati manageme	isaster and Waste management: disaster, concept of disaster, cause of disaster, major natural cyclones, Tsunami, disaster management, forms of waste, on of waste, sources of waste their effects and waste ent	20 L ectures
Unit III – Natural res Sustainabi operating	Sustainable Development: sources, ever increasing power requirement, renewable resources, lity, conservation, Environmental clearance for establishing and Industries in India. Wildlife protection act,	15 Lectures
Reference 1) Environ	e Book :- Imental Management Smita Salunke	

Course Code	SUBJECT SEMESTER II (Mechanical) Practicals	Credits
USARM 2P1	SARM ELECTRICAL FUNDAMENTALS (II) 2P1	
NOTE: following 1. Famili 2. Measu 3. Measu 4. To stur- inspec 5. To test 6. Famili perform 7. To der of AC 8. To fam use an 9. 9)To I by LC 10. Conne measu 11. Single delta c 12. Const Freque 13.Constr freque 14. Use of 15. Make f and bar	Students will have to perform minimum 12 practicals from list of Practicals: arization with transformers rement of output voltage of DC generator rement of output voltage of alternator dy the constructional part of DC Generator/Motor & Perform the tion and operation of DC Generator/motor the armature in Growler and through millimeter / test lamp. arize the constructional part of AC generator and motor & m the inspection and operation of AC Generator/Motor. monstrate the reversing the direction of rotation and speed control motor/DC motor. hiliarize the current and voltage transformer and demonstrate the d testing by simple circuit. dentify the various type of Inductor and measurement its value R Q meter , ection of the Inductor in series, parallel and in combination and re the value of inductor through Inductor meter. e phase and three phase power supply distribution using star and onnection ruct series LCR circuit and determine its (a) Resonant ency, Quality Factor, uct parallel LCR circuit and determine its (a) Anti-resonant ncy and (b) Quality factor Q transformer in power distribution and measurements. Filters circuit to study function of low pass, high pass, band pass d stop	50 lectures

Course Code	SUBJECT SEMESTER II (Mechanical) Practicals	Credits
USARM 2P2	ELECTRONIC FUNDAMENTALS (1)	Credits 2 Lectures 50
NOTE: following 1) Identif 2) Study 3) Study 3) Study 5) Identif perfor 6) Study 7) Study 8) Study 8) Study 9) To che 10) To obs after the	Students will have to perform minimum 08 practicals from list of Practicals: fication of components of R, L, C and measure values of the features and controls of CRO & Multi meter of Operating Controls of Voltmeter, Ammeter, Power meter, meter, DMM for its use the characteristics of Electron Tube fication of Semiconductor devices – Diodes, Transistors and m their characteristics of SCR and its characteristics and waveform of Zener diode and its characteristics and waveform the working of Half wave, Full wave, Bridge Rectifier and we the waveform eck UJT transistor and perform its characteristics serve the performance of choke input and capacitance input filter the rectification circuit	50 lectures

SUBJECT SEMESTER II (Mechanical) Practicals	Credits
AIRCRAFT STRUCTURE & MAINTENANCE PRACTICES(1)	Credits 2 Lectures 50
Students will have to perform minimum 20 practicals from list of Practicals: {From Unit I minimum 8 Practicals & from Unit m 8 Practicals}	
MAINTENANCE PRACTICES(I) will have to perform minimum 06 practicals from following list als)	
cation of various rivets and use of any one riveting technique cation of various fasteners and locking devices used in aircraft. patch riveting patch riveting int by Riveting. int by Riveting. rectangular doubler stration of simple soldering tasks. stration of electric arc welding. nonstration of oxy Acetylene welding. Survey of corrosion prone d suggestion for remedial action. nonstration of the wire and cotter pin licking practice.	25 lectures
AIRCRAFT STRUCTURE will have to perform minimum 06 practicals from following list als) handling precautions, selection of appropriate tools and manuals. nal numbers to record location. Use parts catalog & component n manual to locate components. ying different parts of aircraft. And their operation on aircraft. inspection of various types of surface defects of aircraft structure imple aids like magnifying glass, light and mirror. nal and station numbers to record defect location	25 lectures
	SUBJECT SEMESTER II (Mechanical) Practicals AIRCRAFT STRUCTURE & MAINTENANCE PRACTICES(I) Students will have to perform minimum 20 practicals from list of Practicals: {From Unit I minimum 8 Practicals & from Unit m 8 Practicals} MAINTENANCE PRACTICES(I) will have to perform minimum 06 practicals from following list als) cation of various rivets and use of any one riveting technique (cation of various fasteners and locking devices used in aircraft. patch riveting e patch riveting int by Riveting. mectangular doubler Instration of simple soldering tasks. Istration of electric arc welding. Survey of corrosion prone d suggestion for remedial action. nonstration of the wire and cotter pin licking practice. AIRCRAFT STRUCTURE will have to perform minimum 06 practicals from following list us) handling precautions, selection of appropriate tools and manuals. nal numbers to record location. Use parts catalog & component n manual to locate components. ying different parts of aircraft. And their operation on aircraft. inspection of various types of surface defects of aircraft structure imple aids like magnifying glass, light and mirror. nal and station numbers to record defect location ication and inspection of flight control system

- 7) Inspection for lightning strike protection
- 8) Identification of types of rivets: specifications and identification,
- 9) Demonstration of Lap / But Joint by Riveting.
- 10) Demonstration of the Inspection and lubrication of aircraft control cable
- 11) Survey of corrosion prone area and suggestion for remedial action.

UNIVERSITY OF MUMBAI SYLLABUS (Revised) for the S.Y.B.Sc. Program: B.Sc.(Aeronautics)

(Mechanical)

(Choice Based and Credit System with effect from the academic year 2020- 2021)

Evaluation scheme							
Semester	Course Code	Course Title	Credits	Lecture one hour duration	Practical code	Credit s	Lectur e one hour duratio n
111	USARM 301	MAINTENANCE PRACTICES (II)	3	70	USARM 3P1	2	50
	USARM 302	AVIATION LEGISLATION (I)	3	70	USARM 3P2	2	50
	USARM 303	DIGITAL AND COMPUTOR TECHNIQUES	3	70	USARM 3P3	2	50
	USARM 304	AIRCRAFT MATERIALS	2	50			
	USARM 305	THEORY OF FLIGHT & FLIGHT CONTROLS	3	70			
	USARM 3P1	AIRCRAFT MATERIALS & MAINTENANCE PRACTICES(II)	2				
	USARM 3P2	DIGITAL AND COMPUTOR TECHNIQUES	2				
	USARM 3P3	THEORY OF FLIGHT & FLIGHT CONTROLS	2				
			20				

Evaluation scheme					
Theory		Internal Marks	Semester end examination marks	Total Marks	Duration of examination
USARM 301		25	75	100	2.5 HOURS
USARM 302		25	75	100	2.5 HOURS
USARM 303		25	75	100	2.5 HOURS
USARM 304		25	75	100	2.5 HOURS
USARM 305		25	75	100	2.5 HOURS
UCADM 2D1	Unit 1	-	50	100	2.5 HOURS
USARM SP1	Unit 2	-	50		2.5 HOURS
USARM 3P2			50	50	2.5 HOURS
USARM 3P3		_	50	50	2.5 HOURS
				700	

Course Code	SUBJECT SEMESTER III (Mechanical) Theory	Credits
USARM 301	MAINTENANCE PRACTICES (II)	Credits 3 Lectures 70
Unit I – Electrical Wiring Interconnection System (EWIS) Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Identification of wire types, their inspection criteria and damage tolerance. Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding. EWIS installations, inspection, repair, maintenance and cleanliness standards Sheet Metal Marking out and calculation of bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.		
Unit II – Fasteners Screw threads, Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; Measuring screw threads; Bolts, studs and screws Bolt types: specification, identification and marking of aircraft bolts, international standards; Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels. Riveting Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.		
Unit III – Maintenance Procedures Maintenance planning; Modification procedures; Stores procedures; Certification/release procedures; Interface with aircraft operation; Maintenance Inspection/Quality Control/Quality Assurance; Additional maintenance procedures. Control of life limited components Abnormal Events (a) Inspections following lightning strikes and HIRF penetration. (b) Inspections following abnormal events such as heavy landings and flight through turbulence./ Jet Blast/ Tire Burst incident.		
Reference 1) Airfram 2) Shop Tl 3) Civil Ai	Book :- le & Powerplant Mechanics (General Handbook EA-AC 65-9A) neory J. A Enderson & Tatro frcraft Inspection Procedure (CAP 459)	

Course Code	SUBJECT SEMESTER III (Mechanicals) Theory	Credits	
USARM 302	AVIATION LEGISLATION (1)	Credits 3 Lectures 70	
Unit I: Regulatory framework. Role of ICAO; the aircraft act and rule made there under; role of DGCA; relationship between CAR-21, CAR-M, CAR-145, CAR-66, the aircraft rules (applicable to aircraft maintenance and release); aeronautical information circulars (applicable to aircraft maintenance and release);CAR section 2volume I.			
Unit II: CAR- 66, CAR 145 and Aircraft operations CAR 66 Certifying staff maintenance Detailed understanding of CAR-66. CAR 145 – Approved maintenance organizations Detailed understanding of CAR 145 and CAR M subpart F. Aircraft Operations Commercial air transport/ Commercial operations Air operators certificate; Operator's responsibilities, in particular regarding continuing airworthiness and maintenance.			
 Unit III : Aircraft Certification (a) General -certification rule: such a FAA and EACS 23/25/27/29; Type certification; Supplemental type certification; CAR – 21 Design/Production organization approvals. Aircraft modifications and repairs approval and certification permit to fly requirements. (b) Documents: Certificate of airworthiness; Certificate of registration; noise certificate; weight schedule; radio station license and approval 			
Reference 1. CA 2. CA 3. CA 4. CA	Book :- R by DGCA R 66 by DGCA R 145 by DGCA R 21 by DGC		

Course Code	SUBJECT SEMESTER III (Mechanical) Theory	Credits
USARM 303	DIGITAL AND COMPUTOR TECHNIQUES	Credits 3 Lectures 70
Unit I - a) Electron layout of e b) Numbe hexadecin octal and I c) Data Ce application and outpu d) Data Be knowledge e) Logic C equivalent diagrams.	nic Instrument SystemsTypical systems arrangements and cockpit electronic instrument systems. ring Systems Numbering systems: binary, octal and hal; Demonstration of conversions between the decimal and binary, nexadecimal systems and vice versa. onversion Analogue Data, Digital Data; Operation and n of analogue to digital, and digital to analogue converters, inputs ts, limitations of various types. uses Operation of data buses in aircraft systems, including e of ARINC and other specifications. Circuits Identification of common logic gate symbols, tables and t circuits; Applications used for aircraft systems, schematic Interpretation of logic diagrams.	25 Lectures
Unit II - a) Basic Computer Structure Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memory devices such as RAM, ROM, PROM); Computer technology (as applied in aircraft systems). Computer related terminology; Operation, layout and interface of the major components in a microcomputer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation of typical memory devices; Operation, advantages and disadvantages of the various data storage systems. b) Microprocessors – Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit. c) Integrated Circuits - Operation and use of encoders and decoders Function of encoder types Uses of medium, large and very large scale integration. d) Multiple wing		25 Lectures

Operation, application and identification in logic diagrams of multiplexers			
and demultiplexers.			
e) Fibre Optics –			
Advantages and disadvantages of fibre optic data transmission over electrical			
wire propagation; Fibre optic data bus;			
Fiber optic related terms; Terminations; Couplers, control terminals, remote			
terminals; Application of fibre optics in aircraft systems.			
Unit III -			
a) Electronic Displays Principles of operation of common types of			
displays used in modern aircraft, including Cathode Ray Tubes, Light Emitting			
Diodes and Liquid Crystal Display.			
b) Electrostatic Sensitive Devices Special handling of components			
sensitive to electrostatic discharges; Awareness of risks and possible damage,			
component and personnel anti-static protection devices.			
c) Software Management Control – Awareness of restrictions, airworthiness			
requirements and possible catastrophic effects of unapproved changes to			
software programmes			
d)Electromagnetic Environment – Influence of the following phenomena on			
maintenance practices for electronic system: EMC-Electromagnetic	20		
Compatibility EMI-Electromagnetic Interference HIRF-High Intensity	ZU		
Radiated Field Lightning/lightning protection	Lectures		
e) Typical Electronic/Digital Aircraft Systems – General arrangement of			
typical electronic/digital aircraft systems and associated BITE(Built In Test			
Equipment) testing such as: (a) For B1 and B2 only:			
ACARS-ARINC Communication and Addressing and Reporting System			
EICAS-Engine Indication and Crew Alerting System FBW-Fly by Wire			
FMS-Flight Management System IRS-Inertial reference system (b) For B1,			
B2 and B3:			
ECAM-Electronic Centralised Aircraft Monitoring			
EFIS-Electronic Flight Instrument System GPS-Global Positioning System			
TCAS-Traffic Collision Avoidance system			
Integrated modular Avionica Cabin System Information system			
Reference Book :-			
1) Aircraft Instruments and Integrated System E.H.J. Pallett			
2) Digital Principles and Applications by DONALD P. LEACH, ALBERTPAUL ALVINO,			
GOUTAM SAHA			
(3) Assistion algotropics Kaith W/ Rosa			
Course Code	SUBJECT SEMESTER III (Mechanical) Theory	Credits	
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USARM 304	AIRCRAFT MATERIALS	Credits 2 Lectures 50	
 Unit I - a) Aircraft Materials — Ferrous Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance. b) Aircraft Materials — Non-Ferrous Characteristics, properties and identification of common non-ferrous materials used in aircraft; Heat treatment and application of non-ferrous materials; Testing of non-ferrous material for hardness, tensile strength, fatigue strength, fatigue strength and impact resistance. 			
Unit II - a) Aircraft Composite Characteri nonmetalli agents. (b) The de material. c) Repair o	Materials - Composite and non-metallic other than wood and fabric. stics, properties and identification of common composite and c materials, other than wood, used in aircraft; Sealant and bonding tection of defects/deterioration in composite and non-metallic of composite and non-metallic material and Non- Metallic	15 Lectures	
Unit III - Wooden a fabric. airf fabric glue fabric strue structures; b) Plastics Thermoset	nd fabric structures Construction methods of wooden and rame structures; Characteristics, properties and types of wood and used in aero planes Preservation and maintenance of wooden and cture; Types of defects in wood and fabric material and wooden Different types of plastics used in aircraft Thermoplastics and ting plastics. Cleaning ,Storage and Handling Plastics	15 Lectures	

c) Corrosion Chemical fundamentals; Formation by, galvanic action
process, microbiological, stress; Types of corrosion and their identification;
Causes of corrosion; Material types, susceptibility to corrosion.
Reference Book :-
1) Aircraft Materials and Processes George F. Titterton
2) Aviation Maint. Technician Hand Book-General -9A FAA
3) Advanced Composites Cindy Foreman
4) Civil Aircraft Inspection Procedures (CAP 459) CAIP I
5) EASA Module-06 Hardware And Materials AIRCRAFT TECH BOOK CO

Course Code	SUBJECT SEMESTER III (Mechanical) Theory	Credits
USARM 305	THEORY OF FLIGHT & FLIGHT CONTROLS	Credits 3 Lectures 70
Unit I - Flight Co Primary co control; High lift d pneumatic limiter, gu Balancing	ntrols ontrols: aileron, elevator, rudder, spoiler; Trim control; Active load evices; Lift dump, speed brakes; System operation: manual, hydraulic, , electrical, fly-by-wire; Artificial feel, Yaw damper, Mach trim, rudder st locks systems; and rigging; Stall protection/warning system	25 L ectures
Unit II – High Speed of number, c aerodynan of high sp	ed Flight sound, subsonic flight, transonic flight, supersonic flight, Mach critical Mach number, compressibility buffet, shock wave, mic heating, area rule; Factors affecting airflow in engine intakes beed aircraft; Effects of sweepback on critical Mach number.	25 L ectures
Unit III - Autopile Fundame and cur operation Yaw dan Autopilot Landing S glideslope	ot: entals of automatic flight control including working principles rent terminology; Command signal processing; Modes of n: roll, pitch and yaw channels; npers; Stability Augmentation Automatic trim control; navigation aids interface; Auto throttle systems. Automatic Systems: principles and categories, modes of operation, approach, e, land, go around, system monitors and failure conditions	20 L ectures
Reference 1) Mechar 2) Aviatio 3) FAA H 4) Autom	e Book :- nics of Flight AC Kermode on Maint Technician Hand Book-General -9A FAA I- 8083-31 Aviation Maint. Technician Handbook-Airframe 15A atic Flight control by Pallett	

Course Code	SUBJECT SEMESTER III (Mechanical) Practicals	Credits		
USARM 3P1	M AIRCRAFT MATERIALS& MAINTENANCE PRACTICES (II)			
NOTE: following & from U UNIT -1 M (Students Practicals) 1) Inspect 2) Demon 3) Demon 4) Demon 5) Use Pr 6) Use Pr 6) Use Pr 7) Operati 8) Demon 9) Identifi 10)Demon 11) Test 12) Insp 13) Insp 14) Insp	Students will have to perform minimum 20 practicals from list of Practicals: {From Unit I minimum 8 Practicals nit II minimum 8 Practicals} MAINTENANCE PRACTICES will have to perform minimum 8 practicals from following list of ion and testing of springs stration of DPI, MPI, FPI. stration of Electric Arc, Gas welding stration of Soldering. 5) Demonstration of Brazing ecaution & operation of hand tools used in workshop ecaution & operation of power tools used in workshop on and use of precision measuring tools; stration of Single/Double patch riveting cation of types of rivets: specifications and identification, stration of Lap / But Joint by Riveting. ing, cleaning, inspection & lubrication of bearings ection of gears, including backlash check ection of belts & pulleys, chains & sprockets ection of screw jacks, lever devices, push-pull rod systems.	25 L ectures		
UNITI (Students Practicals) 1. Identifi aircraft 2. Charac materia	AIRCRAFT MATERIALS will have to perform minimum 8 practicals from following list of cation of common alloy steels and nonferrous alloys used in s; teristics, properties and identification of common composite 1	25 Lectures		

3.	Characteristics, properties and identification of Sealant and bonding	
	agents	
4.	The detection of defects/deterioration in composite and non-metallic	
	material	
5.	Repair of composite and non-metallic material	
6.	Identification of various types of corrosion.	
7.	Thread forms, dimensions and tolerances for standard threads used in	
	aircraft	
8.	Identification of various types of bolts used in aircraft.	
9.	Identification of various types of nuts used in aircraft.	
10	Identification of various types of washers used in aircraft.	
11	Fitment and removal of various types of tabs used in aircraft.	
12	Insertion and removal of various types studs in aircraft.	
13	Fitment and removal of split pins, pal nuts, wire locking,	
14	Fitment and removal of quick release fasteners, keys, circlips, and	
	cotter pins.	

Course Code	SUBJECT SEMESTER III (Mechanical) (PRACTICALS)	Credits
USARM 3P2	DIGITAL AND COMPUTOR TECHNIQUES	Credits 2 Lectures 50
NOTE:- following 1) Peri 2) Peri 3) Peri 4) Intri 5) Ope 6) Aw 7) Uni 8) To 5 9) Ider 10) To 11) S 12) S 13) P 14) A 15) C 16) C 16) C 17) U 18) (Act 19)Inte	 Students will have to perform minimum 16 practicals from list of Practicals Form the addition of two numbers on microprocessor 8085 kit. Form the subtraction of two numbers on microprocessor 8085 kit. Form the operation of complement of number on 8085 kit. Form the operation of computer. Foration and identification of electrostatic discharge devices. Form the operation of A to D converter/ D to A converter. Form the operation of grounding and bonding. Fudy of ARINC 429/629 BUS. Fudy of Fiber optic cable. Fumphlet Design in MS-WORD 2007 Formative Worksheet Design in MS-EXCEL 2007 Formative Different Slides in MS-POWERPOINT 2007 with Ferent Transitions Usage of Record Sets, Passing & Returning of Record Set from a cedure, Usage of Command Object – Parameter Collection Class creation and Usage, Usage of ActiveX components – both For the subtraction or VB 6.0 	50 lectures

Course Code	SUBJECT SEMESTER III (Mechanical) (PRACTICALS)	Credits
USARM 3P3	THEORY OF FLIGHT & FLIGHT CONTROLS	Credits 2 Lectures 50
<u>NOTE</u> : following 1) Operati 2) Operati 3) Manual 4) Operati 5) Check 6) Operati 7) Stall pr 8) Operati 9) Operati 10) Man 11) Operati 12) Check	Students will have to perform minimum 12 practicals from list of Practicals ional check of aileron, elevator, rudder, ional check of Flap, Slat l/Electrical Trim control check ion check of Ground/ Flight spoilers of Artificial feel, Yaw damper, ional check of Mach trim, Rudder limiter otection/warning system check ional check of aileron, elevator, rudder, ional check of Flap, Slat nual/Electrical Trim control check irration check of Ground/ Flight spoilers ck of Artificial feel, Yaw damper,	50 lectures
13) Ope 14) Stal	rational check of Mach trim, Rudder limiter l protection/warning system check	

Evaluation scheme							
Semester	Course Code	Course Title	Credits	Lecture one hour duration	Practical code	Credits	Lectur e one hour durati on
IV	USARM 401	AVIATION LEGISLATION (II)	3	70	USARM 4P1	2	50
	USARM 402	AIRCRAFT FUEL AND FUEL SYSTEM	3	70	USARM 4P2	2	50
	USARM 403	AIRCRAFT HYDRAULIC & OXYGEN SYSTEM	3	70	USARM 4P3	2	50
	USARM 404	PISTON ENGINE & SYSTEMS	3	70			
	USARM 405	PROPELLER	2	50			
	USARM 4P1	PISTON ENGINE & AIRCRAFT FUEL SYSTEM	2				
	USARM 4P2	HYDRAULIC & OXYGEN SYSTEM	2				
	USARM 4P3	PROPELLER	2				
			20				

Evaluation scheme						
Theory		Internal Marks	Semester end examination marks	Total Marks	Duration of examination	
USARM 401		25	75	100	2.5 HOURS	
USARM 402		25	75	100	2.5 HOURS	
USARM 403		25	75	100	2.5 HOURS	
USARM 404		25	75	100	2.5 HOURS	
USARM 405		25	75	100	2.5 HOURS	
USADM /D1	Unit 1	-	50	100	2.5 HOURS	
USAKWI 4P1	Unit 2	-	50	100	2.5 HOURS	
USARM 4P2		-	50	50	2.5 HOURS	
USARM 4P3		-	50	50	2.5 HOURS	
				700		

Course Code	SUBJECT SEMESTER IV (Mechanical) Theory	Credits
USARM 401	AVIATION LEGISLATION (II)	Credits 3 Lectures 70
Unit I – CAR- M, CAR-M – continuing Applicabl (a) - Mai Master M Deviatior manufact Maintena manual, i (b) Conti dispatch f RNP, MN	applicable National and international requirements -Detailed understanding of CAR 21 provisions related to g airworthiness Detailed understanding of CAR – M e National and international requirements ntenance Programme, Maintenance checks and inspections; linimum Equipment Lists, Minimum Equipment List, Dispatch a Lists; Airworthiness Directives; Service Bulletins, urers service information; Modifications and repairs; nce documentation: maintenance manuals, structural repair llustrated parts catalogue, etc. inuing airworthiness; Test flights; ETOPS, maintenance and requirements; RVSM, maintenance and dispatch requirements NPS Operations All Weather Operations,	25 Lectures
Unit II - Safety M State Safe SMS Ope Special F the FAA Limitatio Fuel Tank Special Fe the FAA a Limitation	Ianagement System and Fuel Tank Safety anagement System ety Programme Basic Safety Concepts Hazards & Safety Risks eration SMS Safety performance Safety Assurance ederal Aviation Regulations (SFARs) from 14 CFR SFAR 88 of and of JAA TGL 47 Concept of CDCCL, Airworthiness ns Items (ALI) & Safety deral Aviation Regulations (SFARs) from 14 CFR SFAR 88 of nd of JAA TGL 47 Concept of CDCCL, Airworthiness s Items (ALI)	25 Lectures

Unit III -	
General policy and procedure adopted by DGCA Procedure for holding examinations proficiency checks etc. for holding defense personal to fulfill the requirements for grant of civil licenses procedure for appeal on order issue under Rule 30 of Aircraft Rules 1937 Regulatory Documents Management system. Miscellaneous Requirements Weight and balance control of Aircraft, Provision of medical supplies, Aircraft log books, Documents to be carried on Board, issue of Taxi permit. Flammability requirements for furnishing materials to be used on Aircraft CAR section I and CAR section II volume II	25 Lectures
Reference Book :- 1. CAR by DGCA 2. CAR 66 by DGCA 3. CAR 145 by DGCA 4 CAR 21 by DGC	

Course Code	SUBJECT SEMESTER IV (Mechanical) Theory	Credits
USARM 402	AIRCRAFT FUEL AND FUEL SYSTEM	Credits 3 Lectures 70
Unit I - Types of Fuels, De Number I Types of Turbine E Independ	Aviation Fuel. Volatility, Vapor Lock. Carburetor Icing. Aromatic tonation, Surface Ignition and Preignition, Octane and Performance Rating, Fuel Identification Purity Aviation Fuel Reciprocating Engine Fuel—AVGAS Engine Fuels Basic Fuel System Requirements, Fuel System ence, Fuel System Lightning Protection.	25 Lectures
Unit II – a) Fuel F Fuel Syst b) Fuel T Expansio Vents and c) Fuel S Filter, Fue d)Fuel Sy System L	low, Flow Between Interconnected Tanks Unusable Fuel Supply em Hot Weather Operation. Fanks Fuel Tank Tests. Fuel Tank Installation, Fuel Tank n Space. Fuel Tank Sump, Fuel Tank Filler Connection. Fuel Tank d Carburetor Vapor Vents, Fuel Tank Outlet ystem Components. Fuel Valves and Controls, Fuel Strainer or el System Drains. ystem lay-out; Fuel tanks; Supply systems; Fuel Pumps Fuel ines and Fittings	25 Lectures
Unit III - Aircraft F Feed Syst System S Reciproca Jet Transp	uel Systems Small Single-Engine Aircraft Fuel Systems. Gravity ems, Pump Feed Systems, High-Wing Aircraft With Fuel Injection mall Multiengine (Reciprocating) Aircraft Fuel Systems. Large ating-Engine Aircraft Fuel Systems	20 Lectures

and defueling; Longitudinal balance fuel systems. Dumping, venting and draining; Cross-feed and transfer; Fuel Indications and warnings;

Reference Book :-

1) Aviation Maint Technician Hand Book-Airframe -15A --- FAA

2) A & P Technician Air Frame Text Book ---- Jeppesen

3) Civil Aircraft Inspection Procedure (CAP 459)---(CAIP II)

Course Code	SUBJECT SEMESTER IV (Mechanical) Theory	Credits	
USARM 403	AIRCRAFT HYDRAULIC & OXYGEN SYSTEM	Credits 3 Lectures 70	
Unit I - Hydraulic Power and Pneumatic/Vacuum Systems: System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems. Filters.			
Unit II - Pneumat System la supply; P with othe	ic/Vacuum Systems: y-out; Sources: engine/APU, compressors, reservoirs, ground ressure control; Distribution; Indications and warnings; Interfaces r systems.	20 Lectures	
Unit III - Oxygen S Oxygen s systems; I Installatic provision	System : ystem: Purpose of the system; Safety portable & fixed Oxygen low pressure and high pressure oxygen system & components; on and replacement of Oxygen lines. General familiarization with of emergency equipment on modern aircraft	20 Lectures	
Reference 1) Aviatio 2) A & P 3) Civil A	Book :- on Maint Technician Hand Book-Airframe -15A FAA Technician Air Frame Text Book Jeppesen ircraft Inspection Procedure (CAP 459)(CAIP II)		

Course Code	SUBJECT SEMESTER IV (Mechanical) Theory	Credits
USARM 404	PISTON ENGINE & SYSTEMS	Credits 3 Lectures 70
Unit I - a) Fundar Mechanica stroke, For ratio; Eng b)Engine Power calo Mixtures/I c) Engine Accessory and exhaus d) Engine Carburetor heating. For operation. metering s Systems la	nentals al, thermal and volumetric efficiencies; Operating principles Two ar stroke, Otto and Diesel; Piston displacement and compression ine configuration and firing order. Performance culation and measurement; Factors affecting engine power; eaning, pre-ignition. Construction Crank case, crank shaft, cam shafts, sumps; gearbox; Cylinder and piston assemblies; Connecting rods, inlet st manifolds; Valve mechanisms; Propeller reduction gearboxes. Fuel Systems rsTypes, construction and principles of operation; Icing and ael injection systems Types, construction and principles of Electronic engine control Operation of engine control and fuel ystems including electronic engine control (FADEC); ry-out and components.	25 Lectures
 Unit II - a) Starting sy principles tension sys Constructi systems Ex b) Superc Principles parameters systems; S c) Lubrica 	g and Ignition Systems stems, pre-heat systems; Magneto types, construction and of operation; Ignition harnesses, spark plugs; Low and high stems. Induction, Exhaust and Cooling Systems on and operation of: induction systems including alternate air khaust systems, engine cooling systems — air and liquid. harging/Turbocharging and purpose of supercharging and its effects on engine s; Construction and operation of supercharging/turbocharging ystem terminology; Control systems; System protection. ants and Fuels Fuel additives; Safety precautions.	25 Lectures

 Unit III - a) Lubrication Systems System operation/lay-out and components. b) Engine Indication SystemsEngine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure. c) Power plant Installation Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains. d) Engine Monitoring and Ground Operation Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer. e) Engine Storage and Preservation - Preservation and DE preservation for the engine and accessories/ systems 	20 Lectures
Reference Book :- 1) Aircraft Piston Engines Herschel Smith 2) Aircraft powerplant -12AKroes and Wild 2) EAA U 2082 22 Aviation Maint Technician Handbook Deverylant (Val	Ш

Course Code	SUBJECT SEMESTER IV (Mechanical) Theory		
USARM 405	PROPELLER	Credits 2 Lectures 50	
Unit I - a)Fundamen angle of at Aerodynan Relative at b) Propell Constructi propellers; assembly; Propeller/s	nentals tals Blade element theory; High/low blade angle, reverse angle, tack, rotational speed; Propeller slip; nic, centrifugal, and thrust forces; Torque; rflow on blade angle of attack; Vibration and resonance. er Construction on methods and materials used in wooden, composite and metal Blade station, blade face, blade shank, blade back and hub Fixed pitch, controllable pitch, constant speeding propeller; spinner installation.	15 Lectures	
Unit II - a) Propelle Speed con electrical/e Feathering b) Propelle Synchron	er Pitch Control trol and pitch change methods, mechanical and electronic; and reverse pitch; er Synchronising ising and synchrophasing equipment	20 Lectures	
Unit III - a) Propelle Fluid and (b) Propelle Static and Assessmen delaminati c) Propelle	er Ice Protection electrical de-icing equipment. er Maintenance dynamic balancing; Blade tracking; nt of blade damage, erosion, corrosion, impact damage, on; Propeller treatment/repair schemes; Propeller engine running. er Storage and Preservation preservation and DE preservation	15 Lectures	
Reference 1) Aircraft 2) Aircraft 3) FAA H	Book :- A & P Technician Power Plant Jeppesen Propeller and Controls Frank Delp - 8083-32 Aviation Maint.Technician Handbook-Powerplant (Vol-I)		

Course Code	SUBJECT SEMESTER IV (Mechanical) Practicals PRACTICALS	Credits
USARM 4P1	PISTON ENGINE & AIRCRAFT FUEL SYSTEM	Credits 2 Lectures 50
 <u>NOTE</u>: Students will have to perform minimum 20 practicals from following list of Practicals: {From Unit I minimum 8 Practicals & from Unit II minimum 8 Practicals} UNIT I AIRCRAFT FUEL SYSTEM (Students will have to perform minimum 8 practicals from following list of Practicals) 1) Familiarization of system lay-out; Fuel tanks; Fuel pumps, valves 2) level indicators & their operation, 3) Operational check-Fuel Supply systems to Engine & APU 4) Operation of dumping, venting and draining; 5) Operation of cross-feed and transfer of fuel; 6) Refueling Small Single-Engine Aircraft 		20 lectures
 7) Pressure 8) Aircraft 9) Identified 10) Quantified 11) Jet Trans 12) Fuel Identified 13) Operation 	e Refueling Systems and Defueling cation and inspection of Fuel system ty Indicating systems functional testing nsport Aircraft Fuel Systems Refueling evel indicators & their operation, onal check-Fuel Supply systems to Engine & APU	
UNIT II	PISTON ENGINE	
 (Students will have to perform minimum 8 practicals from following list of Practicals) 1) Familiarization of Piston engine components: Crankcase, Crankshaft, Camshaft, Bearings, Connecting Rod, Piston, Piston Rings. 2) Spark Plug – Checking, Cleaning & Fouling of Plug 3) Operation of 4 Stroke Engine 4) Operation of 2 Stroke Engine 5) Identifying the different types of carburetors 		

- 6) Propeller Locking, Carburetor Locking
- 7) Working of magneto
- 8) Details about Overhaul and Maintenance of the engine including dismantling, inspection,
- Identification of engine parts such as Crankcase. Accessories case assembly, Oil sump, Crank shaft assemblies, Connecting rods, Piston assemblies, Cylinder assemblies, Valve mechanism, Gear train, Lubrication system, Induction system, Cooling and exhaust system

Course Code	SUBJECT SEMESTER IV (Mechanical) Practicals	Credits			
USARM 4P2	HYDRAULIC & OXYGEN SYSTEM	Credits 2 Lectures 50			
1) Servicing	of hydraulic reservoir				
2) Operation 2	of Hydraulic shut off valve				
3) Charging	of hydraulic accumulator				
4) Discharging of hydraulic accumulator					
5) Check for hydraulic leak					
6) Charging	& Discharging of hydraulic accumulator				
7) Operation	al check of hydraulic system	50 lectures			
8) Carryout s	8) Carryout snag analysis and rectification of Hydraulic system				
9) Pressure controller servicing					
10) Carryo	ut snag analysis and rectification for pneumatic system				
11) Servici	ng of oxygen cylinder & oxygen mask				
12) Carryo	ut snag analysis and rectification for oxygen system				
13)Leak testi	ng of gaseous oxygen system				

Course Code	SUBJECT SEMESTER IV (Mechanical) Practicals	Credits
USARM 4P3	PROPELLER	Credits 2 Lectures 50
NOTE: following PROPELL 1) Famili 2) Prope 3) Propel 4) Famili propel 5) Feathe 6) Propel 7) Icing p 8) Blade	Students will have to perform minimum 8 practicals from list of Practicals ER AND ITS CONTROL:- arization with propeller blade elements ller construction ler blade station numbering arization with fixed pitch, controllable and constant speed ler rring and reverse pitch propeller ler synchronization protection of propeller tracking	50 lectures
9) Propel 10)Storag	ler hub and blade inspection e and preservation of propeller	

UNIVERSITY OF MUMBAI SYLLABUS (Revised) for the T.Y.B.Sc. Program: B.Sc.(Aeronautics) (Mechanical)

(Choice Based and Credit System with effect from the academic year 2020-2021)

Evaluation scheme							
Semester	Course Code	Course Title	Credits	Lecture one hour duration	Practical code	Credi ts	Lectur e one hour durati on
V	USARM 501	LANDING GEAR , WHEELS & BRAKES	3	70	USARM 5P1	2	50
	USARM 502	CABIN ATMOSPHERE CONTROL	3	70	USARM 5P2	2	50
	USARM 503	GAS TURBINE ENGINE (I)	3	70	USARM 5P3	2	50
	USARM 504	AIRFRAME SYSTEM (II)	2	50			
	USARM 505	AIRCRAFT STRUCTURE (II)	3	70			
	USARM 5P1	LANDING GEAR	2				
	USARM 5P2	CABIN ATMOSPHERE CONTROL & AIRCRAFT STRUCTURE (II)	2				
	USARM 5P3	GAS TURBINE ENGINE (I)	2				
			20				

Evaluation scheme						
Theor	у	Internal Marks	Semester end examination marks	Total Marks	Duration of examination	
USARM 501		25	75	100	2.5 HOURS	
USARM 502		25	75	100	2.5 HOURS	
USARM 503		25	75	100	2.5 HOURS	
USARM 504		25	75	100	2.5 HOURS	
USARM 505		25	75	100	2.5 HOURS	
USARM 5P1			50	50	2.5 HOURS	
LISADM 5D2	Unit 1 -	-	50	100	2.5 HOURS	
USARM JP2	Unit 2	-	50	100	2.5 HOURS	
USARA 5P3		-	50	50	2.5 HOURS	
				700		

Course Code	SUBJECT SEMESTER V (Mechanical) Theory	Credits
USARM 501	LANDING GEAR , WHEELS & BRAKES	Credits 3 Lectures 70
Unit I –General – Landing gear arrangement, shock strut, electrical and hydraulic landing gear extension and retraction, emergency extension system, nose wheel centering mechanism, nose wheel steering, shimmy dampers.		
Unit II – Brakes – Independent brake system, power operated brake system, power boosted brake system, power brake control valve, nose wheel brakes, single disc brakes, multi disc brakes, segmented rotor brakes, expander tube brake system, inspection and maintenance of brakes, bleeding of brake.		
Unit III – Wheels and tyres Split wheel, removable and fixed flange wheels, different parts of tyres, aircraft tyre maintenance, rethreading and recapping, tube inspections, mounting and demounting of wheels and tyres, Antiskid system, landing gear retraction check, rigging and adjustment.		
Reference E 1) Aviation 2) A & P T 3) Civil Air	Book :- Maint Technician Hand Book-Airframe -15A FAA Sechnician Air Frame Text Book Jeppesen Scraft Inspection Procedure (CAP 459)(CAIP II)	

Course Code	SUBJECT - SEMESTER V (Mechanical) Theory	Credits
USARM 502	CABIN ATMOSPHERE CONTROL	Credits 3 Lectures 70
Unit I – F Fire exting Fire warnin loop fire wa Routine ma	20 Lectures	
Unit II – Atmospher Requirement controls; Sa Humidificat Precautions altitudes; ca controllers; Manual pre- finding.	Pressurization e; Description of a cabin pressure system; Structural nts for pressure cabins; Cabin pressure and rate of change afety; Discharge and Relief Valves; Recirculation systems; tion. to be observed on ground tests; Understanding the pressure abin altitude; Differential pressure; Operations of pressure Outflow valve; Safety Valve; Cabin rate of climb indicator; ssure control valve; Negative pressure relief valve; Fault	25 Lectures
Unit III – Air cycle r component Distribution	Air Conditioning nachines and vapour cycle air conditioning systems. Systems s & their functions n systems; Flow, temperature and humidity control system.	25 Lectures
Reference E 1) Aviation 2) A & P T 3) Civil Air	Book :- Maint Technician Hand Book-Airframe -15A FAA Sechnician Air Frame Text Book Jeppesen Secraft Inspection Procedure (CAP 459)(CAIP II)	

Course Code	SUBJECT SEMESTER V (Mechanical) Theory	Credits
USARM 503	GASTURBINE ENGINE (1)	Credits 3 Lectures 70
Unit I – a) Fundame motion, Bra energy, velo Construction turboprop. b) Engine F thrust distrift horsepower, c) Engine e temperature influence of d) Inlet o Ice protection	20 Lectures	
Unit II – a) Compress Axial and compress Axial and compress principles and Operation: Computed Wethods of variable state b) Combuse Construction c) Turbine blade types; effects of tu d) Exhaust- Convergent, Engine nois	entrifugal types; Constructional features and operating and applications; Fan balancing; Causes and effects of compressor stall and surge; air flow control: bleed valves, variable inlet guide vanes, or vanes, rotating stator blades; Compressor ratio. tion Section nal features and principles of operation. Section Operation and characteristics of different turbine Blade to disk attachment; Nozzle guide vanes; Causes and rbine blade stress and creep. Constructional features and principles of operation; divergent and variable area nozzles; e reduction; Thrust reversers.	25 Lectures
Unit III – a) Bearings Construction Lubricants a	and Seals – nal features and principles of operation. and Fuels Properties and specifications; Fuel additives; Safety	25 Lectures

precautions.	
b) Lubrication Systems	
System operation/lay-out and components.	
c) Air Systems Operation of engine air distribution and anti-ice control	
systems, including internal cooling, sealing and external air services.	

Course Code	SUBJECT SEMESTER V (Mechanical) Theory					
USARM 504	AIRFRAME SYSTEM (11)	Credits 2 Lectures 50				
Unit I – a) Water/V Water syste Toilet syste b) Equipm Safety & E (b) Cabin I Cabin enter Galley insta Lights (AT External: na cargo; Eme General far aircraft suc CVR; Fire	 Vaste (ATA 38) em lay-out, supply, distribution, servicing and draining; em lay-out, flushing and servicing; Corrosion aspects. ent and Furnishings (ATA 25) mergency equipment requirements; Seats, harnesses and belts. ay-out; Equipment lay-out; Cabin Furnishing Installation; tainment equipment; Air stairs allation; Cargo handling and retention equipment's A 33) avigation, anti-collision, landing, taxiing, Internal: cabin, cockpit, ergency niliarization with provision of emergency equipment on modern h as Emergency exits; Megaphone; Signaling Flares; FDR & Extinguishers. 	15 Lectures				
Unit II - Electrical I Batteries In generation; Power distr External/Gr Avionic Sy Fundament Communic	Power (ATA 24) Istallation and Operation; DC power generation; AC power Emergency power generation; Voltage regulation; ibution; Inverters, transformers, rectifiers; Circuit protection. round power; stems als of system lay-outs and operation of; Auto Flight ations, Navigation Systems.	20 Lectures				
Unit III - Ice and Ra Ice formation Anti-icing sy De-icing sy Rain repella	in Protection (ATA 30) on, classification and detection; systems: electrical, hot air and chemical; rstems: electrical, hot air, pneumatic and chemical; ant; Probe and drain heating. Wiper systems	15 Lectures				
Reference E	Book :-					

1) Aviation Maint Technician Hand Book-Airframe -15A FAA	
2) A & P Technician Air Frame Text Book Jeppesen	
3) Civil Aircraft Inspection Procedure (CAP 459)(CAIP II)	

Course code	SUBJECT SEMESTER V (Mechanical) Theory					
USARM 505	AIRCRAFT STRUCTURE (II)	Credits 3 Lectures 70				
Unit I –Ge Construction bulkheads, reinforceme Pylon, stab Doors: con windscreen bonding; M painting; St	neral – on methods of: stressed skin fuselage, formers, stringers, longerons, frames, doublers, struts, ties, beams, floor structures, ent, methods of skinning and anti-corrosive protection. iliser and undercarriage attachments struction, mechanisms, operation and safety devices; Windows and construction; Structure assembly techniques: riveting, bolting, lethods of surface protection, such as chromating, anodising, urface cleaning.	20 Lectures				
Unit II – Fuselage - and underc Doors and windscreen Wings Landing ge Stabilisers Familiariz Emergenc Extinguish warning sy	 Construction and pressurisation sealing; Wing, tail-plane pylon arriage attachments; Seat installation; emergency exits: construction and operation; Window and attachment. Construction; Fuel storage; ar, pylon, control surface and high lift/drag attachments Construction; Control surface attachment. ation with emergency equipment on modern aircraft such as y exits; Megaphone; Signaling Flares; FDR & CVR; Fire bers, Life Jackets, Life Rafts, Escape Slides. Indication and externs 	25 Lectures				
Unit III – Pitot static: Fundament Communic Electrical F generation, External/G and belts; I	Instrument Systems altimeter, air speed indicator, vertical speed indicator; als of system layouts and operation of: Auto Flight, ations Navigation Systems Power Batteries Installation and Operation; DC power AC power generation; Emergency power generation; round power. Emergency equipment requirements; Seats, harnesses ifting systems.	25 Lectures				
Reference E 1) Aviation 2) A & P T 3) Civil Air	Book :- Maint Technician Hand Book-Airframe -15A FAA Technician Air Frame Text Book Jeppesen Tecraft Inspection Procedure (CAP 459)(CAIP II)					

Course Code	SUBJECT Semester V (Mechanical) Practicals	Credits
USARM 5P1	LANDING GEAR	Credits 2 Lectures 50
NOTE: S from follow 1) Locate a 2) Servicin 3) Servicin 4) Nose W 5) Landing 6) Servicin 7) Servicin 8) Servicin 9) Inspecti 10) Carryov 11) Identify 12) Inspect 13) Landin 14) Identify 15) Servici 16) Antiski 17) Replac 18) Carryov ON	Addents will have to perform minimum 15 practicals wing list of Practicals and identify various parts of aircraft landing gear ag of main gear shock strut (Alternate Method) heel Removal / Installation (Gear Lubrication (MLG and NLG) (g of Anti-skid system check (g hydraulic accumulator (g of hydraulic reservoir on of emergency air bottle (ut greasing of various parts of aircraft landing gear y the information given on tire ion of brake system. g gear wheel change on aircraft y the information given on tire ng of oleo pneumatic shock strut d system and its component location e the tires on the aircraft wheel. ut analysis and rectification of Landing Gear warning light	50 lectures

Course Code	SUBJECT Semester V (Mechanical) Practicals				
USARM 5P2	USARM CABIN ATMOSPHERE CONTROL & 5P2 AIRCRAFT STRUCTURE (II)				
NOTE: from follow & from Unit UNIT – 1 : 0 (Students following 1) Check of 2) Operation 3) Fire exti 4) carry ou 5) Find the 6) carry ou 7) Carry ou 8)Carry ou 9) Locate a valve iii) R 10) carry ou 11)Differe weighing a 12) Fire wa fire zones, 13) Locate 14) Locate	Students will have to perform minimum 20 practicals wing list of Practicals: {From Unit I minimum 8 Practicals nit II minimum 8 Practicals} CABIN ATMOSPHERE CONTROL will have to perform minimum 8 practicals from list of Practicals) operation of fire / smoke detection and warning system. onal check of temperature indicating system inguishing systems System tests. ut leak check of aircraft Pressurisation system e location of different Pressurisation system to troubleshooting of pressurization system at snag analysis and rectification of Cabin pressure low tt snag analysis and rectification of Cabin temperature high and identify the following : i) Safety valve ii) Discharge Relief Valve out Removal & Installation of heat exchanger. nt types of fire extinguishers in details recharging, nd certification arning devices, Thermal switches, Thermocouple System, Routine maintenance, inspection and identify various parts of aircraft Fire detection system and identify various parts of aircraft Air cycle Machine air	25 Lectures			

UNIT – II AIRCRAFT STRUCTURE (II)				
 NOTE : Students will have to perform minimum 8 practicals from following list of Practicals 1) Remove cockpit window 2) Check cabin Door operation 3) Find the locations of all Emergency equipment 4) Carry out functions of check Emergency equipment operation 5) Find the Common structural defects, simple inspection technique 	25			
 and recording 6) Check aircraft symmetry 7) Inspection of cabling & wiring and system handling in a/c 8) Operation of primary control surfaces by the movement of pilot's control 	25 Lectures			
 9) Removal / installation of Pitot Static Instruments 10) Familiarization of AFCS control panel 				
11) Calibration of a Pitot Static System using a Pitot Static Leak				
tester.				
12) Familiarization of AFCS control panel				
13) Locate and identify various parts of aircraft Structure				

Course Code	SUBJECT Semester V (Mechanical) Practicals				
USAR M 5P3	GASTURBINE ENGINE-(I)	Credits 2 Lectures 50			
 NOTE:- followin 1) Identi engin 2) Identi engin 3) Identi 4) Engir 5) Identi 6) Identi 7) Identi 8) Identi 9) Reple 10) M 11) F 12) C 13) L instal 14) L on en 15) T 16) E 	-Students will have to perform minimum 14 practicals from g list of Practicals fy engine types, modules and subassemblies and components of turbine es. fy various parts of thrust management and bypass system of turbine e. fication and inspection of compressors stages. le compressor surge and stall management components and control. fication various components of combustion systems and methods of ng's. fication of exhaust system and methods of noise reduction fication and inspection of components of thrust reversal system. fy normal & electronic fuel control, monitoring and indication system nish engine oil ain fuel pump- Purpose, location and mounting method including safety amiliarization of GTE and its components arry out startup of aircraft engine with the precautions ocate and trace the various components of Engine fuel system led on engine. ocate and trace the various components of Engine oil system installed gine ake necessary safety precautions after hot start and hung start ngine dry and wet motoring with the precautions	50 lecture			

Evaluation scheme								
Semester	Course Code	ourse Course Title		Lecture one hour duratio n	Practical code	Cre dits	Lectu re one hour durati on	
VI	USARM 601	GAS TURBINE ENGINE- II	3	70	USAR M 6P1	2	50	
	USARM 602	GROUND HANDLING & DOCUMENTATION	3	70	USAR M 6P2	2	50	
	USARM 603	AIRFRAME SNAGE ANALISIS AND RECTIFICATION	3	70	USAR M 6P3	2	50	
	USARM 604	ENGINE SNAGE ANALISIS AND RECTIFICATION	3	70	USAR M6P4	2	60	PROJE CT
	USARM 6P1	GAS TURBINE ENGINE- II	2					
	USARM 6P2	GROUND HANDLING & DOCUMENTATION	2					
	USARM 6P3	AIRFRAME & ENGINE SNAGE ANALISIS AND RECTIFICATION	2					
	USARM6 P4	INNOVATIVE PROJECT ON AIRFRAME SYSTEM OR ENGINE SYSTEM	2	Proje	ct evaluatio att	on as p ached	Der guid	e lines
			20					

Evaluation scheme						
			Semester			
T1		Internal	end	Total	Duration of	
Theory		Marks	examination	Marks	examination	
			marks			
USARM 601		25	75	100	2.5 HOURS	
USARM 602		25	75	100	2.5 HOURS	
USARM 603		25	75	100	2.5 HOURS	
USARM 604		25	75	100	2.5 HOURS	
USARM 6P1		-	50	50	2.5 HOURS	
USARM 6P2		-	50	50	2.5 HOURS	
LICADM CD2	Unit 1	-	50	100	2.5 HOURS	
USARM 0P3	Unit 2	-	50	100	2.5 HOURS	
LISARM6D4			100	100	2 5 HOUPS	Project evaluation as per
USARMOF4			100	100 2.3 HOURS	guide lines attached	
			700			

Course Code	SUBJECT SEMESTER VI (Mechanical) Theory	Credits
USARM 601	GASTURBINE ENGINE-11	Credits 3 Lectures 70
Unit I – a) Starting Operation of components b) Engine b Turbine Tes engine turb Oil pressure Vibration n c) Power A injection, w d) Turbo-p turbines; Ro Over speed	and Ignition Systems of engine start systems and components; Ignition systems and s; Maintenance safety requirements. Indication Systems - Exhaust Gas Temperature/ Interstage mperature; Engine Thrust Indication: Engine Pressure Ratio, ine discharge pressure or jet pipe pressure systems; e and temperature; Fuel pressure and flow; Engine speed; neasurement and indication; Torque; Power. ugmentation Systems - Operation and applications; Water vater methanol; Afterburner systems. orop Engines Gas coupled/free turbine and gear coupled eduction gears; Integrated engine and propeller controls; safety devices.	25 Lectures
Unit II – a)Turbo-sl couplings, o b) Auxilian systems. c) Power p acoustic pa feeders, con and drains	haft enginesArrangements, drive systems, reduction gearing, control systems. by Power Units (APUs)Purpose, operation, protective lant InstallationConfiguration of firewalls, cowlings, nels, engine mounts, anti-vibration mounts, hoses, pipes, nectors, wiring looms, control cables and rods, lifting points	25 Lectures
 Unit III – a) Fire Prosponse systems. b) Engine I and ground Trend (inclusted in the specified by Foreign Obec) Engine Section I 	tection Systems Operation of detection and extinguishing Monitoring and Ground OperationProcedures for starting run-up; Interpretation of engine power output and parameters; uding oil analysis, vibration and borescope) monitoring; of engine and components to criteria, tolerances and data y engine manufacturer; Compressor washing/cleaning; ject Damage. Storage and Preservation - Preservation and depreservation for	20 Lectures

the engine and accessories/ systems.		
Reference Book :-		
1) Aircraft Gas Turbine Technology by IRWINE TREAGER		
2) The Jet Engine' by ROLLS ROYCE		
3) Civil Aircraft Inspection Procedure (CAP459) Part- II Aircraft		
4) Aircraft Power Plants by M.J.KROES, T. W. Wild, R.D. Bent and J. L		
.Mc KINLEY		
Course Code	SUBJECT SEMESTER VI (Mechanical) Theory	Credits
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USARM 602	GROUND HANDLING & DOCUMENTATION	Credits 3 Lectures 70
Unit I : Need of ground handling tasks during the normal day to day operation of an aircraft & Necessary safety precautions. Different Terms used in Ground handling and Aviation. Aircraft Weight and Balance-Centre of Gravity/Balance limits calculation, use of relevant documents ,Preparation of aircraft for weighing, Aircraft weighing,		
 Unit II - a) Ground support and safety equipment b) Aircraft taxiing / Towing and associated safety precautions, c) Various marshalling & Taxiing Signals. d) Aircraft parking procedure e) Identifying different Aircraft fuel & Refueling /defueling procedures, f) Aircraft jacking, securing and associated safety precautions, g) Aircraft Handling & storage methods, h) Servicing of Aircraft oxygen system i) What is Hot Start , Hung Start , Fail or no start? 		
Unit III - a) Engine starting precautions (jet & piston Engines)b)Operation and Maintenance of different Ground Equipmenti) Aircraft Tow barsii) Aircraft jacksiii) Ground Hydraulic power unitiv) Air starter unitv) Electrical Ground power unitvi) Hanger Facility		
 Reference Book :- 1) Aviation Maint Technician Hand Book- General -9A FAA 2) A & P Technician Air Frame Text Book Jeppesen 3) Civil Aircraft Inspection Procedure (CAP 459)(CAIP II) 		

Course Code	SUBJECT SEMESTER VI (Mechanical) Theory	Credits
USARM 603	AIRFRAME SNAGE ANALISIS AND RECTIFICATION	Credits 3 Lectures 70
Unit I :The snags in the aircraft systems pertaining to syllabus covered in Semester1 to Semester 5 for Airframe systems: namely Hydraulics, Pneumatics, Ice& rain protection, Landing gear, Oxygen, Fire protection, Air conditioning& cabin pressurization. The snag analysis and rectification.		
Unit II –The snags in the aircraft Systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft structureFuselage (ATA 52/53/56)Wings (ATA 57)Stabilisers (ATA 55)Nacelles/Pylons (ATA 54)The snag analysis and rectification.		
Unit III – The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Airframe systems The snag analysis and rectification. Flight Control Surfaces (ATA 55/57) Hydraulic Power (ATA 29) Fuel Systems (ATA 28) Cabin Systems (ATA44) Water/Waste (ATA 38)		
Reference Book :- 1) Aviation Maint Technician Hand Book-Airframe -15A FAA 2) A & P Technician Air Frame Text Book Jeppesen 3) Civil Aircraft Inspection Procedure (CAP 459)(CAIP II)		

Course Code	SUBJECT SEMESTER VI (Mechanical) Theory	Credits
USARM 604	ENGINE SNAGE ANALISIS AND RECTIFICATION	Credits 3 Lectures 70
Unit I :The snags in the Engine systems pertaining to syllabus covered in Semester1 to Semester 5 for systems: namelya) Engine Performance,b) Compressorsc) Combustion Sectiond) Turbine Sectione) Exhaustf) Engine PerformanceThe snag analysis and rectification.		25 Lectures
Unit II – The snags in the Engine systems pertaining to syllabus covered in Semester 1 to Semester 5 for systems: namely a) Bearings and Seals b) Lubricants and Fuels c) Lubrication Systems d) Fuel Systems e) Air Systems &Operation of engine f) Starting and Ignition Systems The snag analysis and rectification.		
Unit III – The snags in the Engine systems pertaining to syllabus covered in Semester 1 to Semester 5 for systems: namely a) Starting and Ignition Systems b) Engine Indication Systems c) Power Augmentation Systems d)Auxiliary Power Units (APUs) e) Fire Protection Systems f) Engine Fuel Systems g) Engine Monitoring and Ground Operation The snag analysis and rectification		
 Reference Book :- 1) Aircraft Gas Turbine Technology by IRWINE TREAGER 2) The Jet Engine' by ROLLS ROYCE 3) Civil Aircraft Inspection Procedure (CAP459) Part- II Aircraft 4) Aircraft Power Plants by M.J.KROES, T. W. Wild, R .D. Bent and J. L .Mc KINLEY 		

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Course Code SUBJECT SEMESTER VI (Mechanical)	Practicals Credits
USARM 6P1 GASTURBINE ENGINE-(11	() Credits 2 Lectures 50
 NOTE:Students will have to perform minimum 16 perform following list of Practicals 1) Familiarization with methods of engine starting and ig systems. 2) Operation check of Engine indicating systems. 3) Familiarization of APU starting and shutdown procedu 4) Familiarization with power plant removal & installation 5) Visual Inspection of engines 6) Typical engine control rigging. 7) Familiarization with engines and airframe interface. 8) Testing of engine fire monitoring and extinguishing op 9) Study engine storage and preservation 10) Take necessary safety precautions after hot start and 11) carry out preflight inspection 12) Removal of Fuel Pump Filter/ Cleaning of Fuel Pum 13) Inspection of Fuel Pump Filter & Installation of Fuel Filter 14) Removal of Fuel Flow-meter / Cleaning of Fuel Flow-Methol 15) Inspection of Fuel / Installation of Fuel Flow-Methol 16) Starter Generator Removal and Installation 17) Removal of O.S.G. Servo Fuel Filter/ Cleaning of C Fuel Filter 18) Inspection of O.S.G. Servo Fuel Filter/ and Installa 19) Removal of Fuel Pressurizing and Drain Valve / C 20) Inspection of Fuel Pressurizing and Drain Valve / a Installation 	racticals nition nition ure on beration d hung start np Filter/ nel Pump meter er D.S.G. Servo tion leaning of nd

Course Code	SUBJECT SEMESTER VI (Mechanical) Practicals	Credits	
USARM 6P2	SUBJECT GROUND HANDLING & DOCUMENTATION	Credits 2 Lectures 50	
NOTE:Students will have to perform minimum 16 practicals from following list of Practicals			
1)Prepar	ation of aircraft for weighing & balancing		
2)Carry	out weight and balance of aircraft		
3) Carry	out taxing aircraft & associated safety precautions		
4) Carry	out jacking up and lowering of aircraft		
5) Use Pi	oper procedure for parking of aircraft		
6) Carry	but refueling of aircraft by Gravity fueling		
7)Carry	7) Carry out defueling of aircraft		
8) Carry out Procedure for lashing and mooring of aircraft			
(9) 10010	9) Towing of Large Aircraft and associated safety precautions 10) Tarring of angli Aircraft and associated safety precautions 50		
10) I(1)	Inspection & Servicing of Aircraft Looks		
11) m 12) Ai	 Aircraft De-icing/anti-icing procedures 		
12) Re	moval/Installation of Aircraft chocks & associated safety		
precautions			
14) Co	nnecting / Dis Connecting Ground power unit. &		
associated safety precautions			
15) Lo	cate & identify the Safety & Emergency Equipment		
16) Pi	16) Piston Engines starting procedure & associated safety		
precautions			
17) Je	Engines starting procedure & associated safety precautions		
18) Ca	rry out refueling of Jet aircraft by Pressure fueling		
19) Ca	rry out Marshalling of Aircraft & associated signals		
20) In	spection & Servicing of Two bar.		

Course Code	SUBJECT SEMESTER VI (Mechanical) Practicals	Credits
USARM 6P3	AIRFRAME & ENGINE SNAGE ANALISIS AND RECTIFICATION	Credits 2 Lectures 50
 NOTE: Students will have to perform minimum 20 practicals from following list of Practicals: {From Unit I minimum 7 Practicals & from Unit II minimum 7 Practicals} UNIT –I AIRFRAME SNAGE (Minimum7 Practicals from unit I) 1) Removal of Fuel Flow-meter 2) Servicing of main gear shock strut (Preferred Method) 3) Servicing of nose gear shock strut (Alternate Method) 4) Landing Gear Lubrication (MLG and NLG 5) Servicing hydraulic accumulator 6) Charging emergency air bottle 7) Anti-skid system check 8) Lubrication of Rudder Pedal Bushings 9) Internal leak check of hydraulic system 10) Remove and Installation of cabin emergency windows 11) Multiple disc brake – removal / cleaning /Inspection 12) Control cable pressure seal replacement 		
 UNIT –I ENGINE SNAGE ANALISIS (Minimum7 Practicals from unit II) 1) Removal & of Cleaning of Fuel Pump Filter 2) Removal & of Oil Filter Cleaning of Fuel Pump Filter 3) Inspection of fuel manifold 4) Removal of Fuel Pressurizing and Drain Valve 5) Inspection of Over Speed Governor 6) Throttle Lever Cable Rigging 7) Removal / cleaning/ Inspection of Fuel Nozzles 8) Inspection of Fuel pump & Fuel control Unit 9) Inspection/Checks of Oil Filter 10) Removal of Fuel Flow-meter 11) Disassembly of Oil Filter 12) Installation of Fuel pump & Fuel control Unit 		

Course Code	SUBJECT Semester VI (Mechanical) Project	Credits
USARM 6P4	INNOVATIVE PROJECT ON AIRFRAME SYSTEM OR ENGINE SYSTEM { MARKS 100}	2
Skill Enhancement Project course are included in third year at 6th Semester in which students can independently think and carry out the project work.60 HOURS		

Project Examination: There will be separate examination for Project Implementation: (100Marks)

Project Evaluation Scheme:

Presentation	Working of the Project	Quality of The Project	Viva	Documentation
20Marks	40 Marks	10 Marks	10 Marks	20Marks

(Certified Project Document is compulsory for appearing at the time of Project Presentation)

Project Implementation Guidelines

I. OBJECTIVES

Develop of the ability to assess the implications of work performed.

Deve Problem definition.

Evaluate project requirements.

Method of collecting information to determine requirements.

Perform and evaluate feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and Operational feasibility for the project.

Schedule projects using both GANTT and PERT charts.

To decide the future scope and further enhancement of the system.

Generate various reports.

Work effectively as an individual or as a team member to produce correct, efficient, well-organized and documented programs in a reasonable time.

op of the ability to communicate effectively.

II. Type of the Project

The majority of the students are expected to work on a real-life project preferably in some industry/ Research and Development Laboratories/Educational Institution/Airline Company. Students are encouraged to work in the areas of undergraduate program. However, it is *not mandatory* for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. Approval of the project proposal is mandatory. If approved, the student can commence working on it, and complete it.

1.1 PROJECT REPORT:

Title Page Copy of the Approved Performa of the Project Proposal Certificate of Authenticated work Abstract Acknowledgement Table of Contents Table of Figures

CHAPTER 1: INTRODUCTION

- 1.1 Background
- 1.2 Rational / Objectives
- 1.3 Purpose, Scope, and Applicability
- 1.4 Achievements
- 1.5 Organisation of Report

CHAPTER 2: SURVEY OF TECHNOLOGIES

Chapter 3. Machine framework or architecture
Chapter 4. Airframe / Engine Design
CHAPTER 5: Final design , IMPLEMENTATION AND TESTING
CHAPTER 6: RESULTS AND DISCUSSION
6.1 Test Reports
6.2 User Documentation
CHAPTER 7: CONCLUSIONS
7.1 Conclusion
7.1.1 Significance of the System
7.2 Limitations of the System
7.3 Future Scope of the Project

REFERENCES

PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be summari rejected.)			
Project Report No : Roll No :			
1. Name of the Student			
2. Title of the Project	· · · · · · · · · · · · · · · · · · ·		
3. Name of the Guide			
Signature of the Student Date:	Signature of the Guide Date:		
Signature of the Head/Coordinator Date:			

(All the text in the report should be in times new roman) TITLE OF THE PROJECT

(NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS) A **Project Report (12 Bold)** Submitted in partial fulfillment of the Requirements for the award of the Degree of (size-12)

BACHELOR OF SCIENCE (Aeronautical -Mechanical) (14 BOLD, CAPS) By(12 Bold) Name of The Student (size-15, title case) Seat Number (size-15) Under the esteemed guidance of (13 bold) Mr./Mrs. Name of The Guide (15 bold, title case) Designation (14 Bold, title case)

COLLEGE LOGO DEPARTMENT OF Aeronautics(12 BOLD, CAPS) COLLEGE NAME (14 BOLD, CAPS) COLLEGE NAME (14 BOLD, CAPS) (Affiliated to University of Mumbai) (13, bold, italic) CITY-MAHARASHTRA-PINCODE(13 bold, CAPS) DEPARTMENT OF AERONAUTICS (14 BOLD, CAPS)

College Logo

CERTIFICATE (14 BOLD, CAPS, underlined, centered) This is to certify that the project entitled, "Title of The Project " is bonafied work of NAME OF THE STUDENT bearing Seat. No: (NUMBER) Semester VI AY 2022-2023 submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in AERONAUTICS-MECHANICAL from University of Mumbai. (12, times new roman, justified)

Internal Guide (12 bold)

External Examiner Name and signature Date: College Seal

COMPANY CERTIFICATE (if applicable)

ACKNOWLEDGEMENT (20, BOLD, ALL CAPS, CENTERED) The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

External Examiner Name and signature Date: College Seal 79

COMPANY CERTIFICATE (if applicable)

ACKNOWLEDGEMENT (20, BOLD, ALL CAPS, CENTERED) The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I here by declare that the project entitled, "**Title of the Project**" done at (place where the project is done), has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of BACHELOR

OF SCIENCE (aeronautics-mechanical) to be submitted as final semester VI project as part of curriculum.

Name and Signature of the student

References (14 bold)

Content (12, LEFT) [1] Title of the book, Author [2] Full URL of online references [3] ------

INFRASTRUCTURE REQUIREMENT

NOTE :---- INFRASTRUCTURE REQUIRED FOR B.SC. AERONAUTICS (Mechanical) WILL REMAINS SAME AS EXCISTING