

AC 27/2/13

Item No. 4.3

UNIVERSITY OF MUMBAI



Syllabus for the T.Y.B.Sc.

Program: B.Sc.

**Course: AERONAUTICS
(MECHANICAL STREAM)**

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

T.Y.B.Sc. AERONAUTICS (MECHANICAL STREAM) Syllabus
Credit Based and Grading System
To be implemented from the Academic year 2013-2014

SEMESTER V (20 Weeks)

THEORY

Course Code	UNIT	TOPICS	Credits	L / Week
USARM501	I	AIRCRAFT STRUCTURE SYSTEMS : AIRCRAFT PRESSURISATION AND AIR CONDITIONING	3	4
	II			
	III			
USARM502	I	AIRCRAFT ELECTRICITY AND ELECTRONICS	3	4
	II			
	III			
USARM503	I	DIGITAL TECHNIQUES, COMPUTERS & INSTRUMENTS	3	4
	II			
	III			
USARM504	I	THEORY OF FLIGHT & AIRCRAFT FLIGHT CONTROLS	3	4
	II			
	III			
USARM505	I	AIRCRAFT ENGINE : PISTON ENGINE & JET ENGINE	3	4
	II			
	III			
PRACTICALS				
USARM5P1	AIRCRAFT STRUCTURE SYSTEMS: AIRCRAFT PRESSURISATION AND AIR CONDITIONING		3	4
	AIRCRAFT ENGINES : PISTON ENGINE & JET ENGINE			
USARM5P2	AIRCRAFT ELECTRICITY AND ELECTRONICS		2	4
	DIGITAL TECHNIQUES, COMPUTERS & INSTRUMENTS			

SEMESTER V (20 Weeks)

Course Code		Credits
USARM501	AIRCRAFT STRUCTURE SYSTEMS : AIRCRAFT PRESSURISATION AND AIR CONDITIONING (THEORY)	3 Credits (75 lectures)
Unit I - AIRCRAFT PRESSURISATION : Atmosphere; Description of a cabin pressure system; Structural Requirements for pressure cabins; Cabin pressure and rate of change controls; Safety; Discharge and Relief Valves; Recirculation systems; Humidification.		25 Lectures
Unit II - AIRCRAFT PRESSURISATION : Precautions to be observed on ground tests; Understanding the pressure altitudes; cabin altitude; Differential pressure; Operations of pressure controllers; Outflow valve; Safety Valve; Cabin rate of climb indicator; Manual pressure control valve; Negative pressure relief valve; Fault finding.		25 Lectures
Unit III - AIR CONDITIONING : Air conditioning; Heating systems; Cooling systems; Maintenance of the various components of the system.		25 Lectures
Reference Book :- Airframe and Power Plant Mechanics (AC65-15A) –Chap:-14. A&P Technician Airframe Text book- Jeppesen- Chap 14. Aircraft Maintenance & Repair- Kroes, Watkins, Delp - Chap :- 16. Civil Aircraft Inspection Procedure (CAIP) – Chap AL3		

Course Code		Credits
USARM502	AIRCRAFT ELECTRICITY AND ELECTRONICS (THEORY)	3 Credits (75 lectures)
Unit I: Aircraft electrical power distribution systems, need for protective devices, electrical load, electrical load analysis, DC electrical systems , power distribution hierarchy, Control of power distribution systems,		25 Lectures
Unit II: Design and maintenance of aircraft electrical systems, typical schematic diagrams, Identification of systems for locating electrical components, aircraft lights.		25 Lectures
Unit III : Maintenance and troubleshooting of electrical system, general requirements, inspection schedule, trouble shooting with built in test equipment centralized fault display system electro-static discharge sensitive equipments System.		25 Lectures
Reference Book : Aircraft Electricity and Electronics by Eismen – Chap :- 12 & 13. Aircraft Electrical Systems by EHJ Pallet – Chap :- 2,4,5 &7.		

Course Code		Credits
USARM503	DIGITAL TECHNIQUES, COMPUTERS AND INSTRUMENTS (THEORY)	3 Credits (75 lectures)
Unit I - Digital: Boolean Algebra, De Morgan theorem, Binary arithmetic Addition, Subtraction, Multiplication, Division, Multiplexer, Demultiplexer, Decoder, Seven Segment Decoder, Encoder, Clock, Flip Flop – RS, D,J,K, Counter basics.		25 Lectures
Unit II - Digital: Memory – Types, Addressing, Basic Structure of Computers, Basic Hardware & Software, Components, Microprocessor Basics & Programming of 8085, Data Transfer system, fiber optics and applications in Aviation, ESDS EMI protection.		25 Lectures
Reference Book : Digital Principles and Applications by Donald Leach/AP Malvino – 3,4,6,8 &10. Aircraft Digital Electronics and Computer System by Mike Tooley – Chap:- 6,7,10,12 &14.		Chap:-
Unit III – Instrument : Electronic display, EFIS, Electronic Instruments for Engine & Airframe system control, EICAS, ECAM, Auto throttle system, INS/IRS system, Stall warning system, Flight Data Recorder System, Flight management system, Maintenance, Trouble shooting .		25 Lectures
Reference Book : Aircraft Instrument and Integrated System (4th Edition) – EHJ Pallet - Chap 11,12,16 & 17		

Course Code		Credits
USARM504	THEORY OF FLIGHT & AIRCRAFT FLIGHT CONTROLS (THEORY)	3 Credits (75 lectures)
Unit I - Theory of Flight : Transonic Speed; compressibility shock, shock waves; shock stall and shock drag; mach Number, critical mach number; sonic barrier; flight at transonic speed; drag and power required.		25 Lectures
Unit II - Theory of Flight : Behavior of airplane at shock stall; shock wave and pressure distribution; sonic bangs; raising critical mach number; controls problems; Area rule; Vortex generators; High speed aerodynamics.		25 Lectures
Unit III - Aircraft Flight Controls : Operation of control surfaces, eleron & Rudder, elevator operation, effect of high lift devices (Slots, Slats & flaps) spoilers & speed brakes,		25 Lectures
Reference Book :- Mechanics of Flight by AC Kermode- Chapters :- 2,3,11 &12.		

Course Code		Credits
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USARM505	AIRCRAFT ENGINES : PISTON ENGINE & JET ENGINE (THEORY)	3 Credits (75 lectures)
Unit I - Aircraft Engine : Piston Engine: Familiarization with particular aircraft engines as Continental “E” series aircraft engine Model E165 and E185 etc.		25 Lectures
Unit II - Aircraft Engine : Jet Engine: Familiarization with particular aircraft engines as fitted on Boeing 747 (P&W JT 9D engine), Boeing 737 (P&W JT 8D engine) etc.		25 Lectures
Unit III – Aircraft Engine: Jet Engine: Familiarization with particular aircraft engines as fitted on Airbus – 310 and 320 aircrafts Viz CF6–80 C2 and CFM 56 engines respectively.		25 Lectures

Course Code		Credits
USARM5P1	(PRACTICALS) AIRCRAFT STRUCTURE SYSTEMS: AIRCRAFT PRESSURISATION AND AIR CONDITIONING	3 Credits (75 lectures)
	(PRACTICALS) AIRCRAFT ENGINES: PISTON ENGINE & JET ENGINE	
UNIT I - AIRCRAFT STRUCTURE SYSTEMS : AIRCRAFT PRESSURISATION AND AIR CONDITIONING 1) Need of aircraft pressurization 2) Structural requirement for pressurized cabins. 3) Purpose and location of i) Safety valve ii) Discharge valve iii) Relief Valve 4) Purpose and location of cabin rate of climb indicator. 5) Understanding i) Pressure Altitude ii) Cabin Altitude		25 Lectures
UNIT II - AIRCRAFT ENGINE : PISTON ENGINE Details about Overhaul and Maintenance of the engine – including dismantling, inspection, repair and assembly with table of limits of all important 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.		25 Lectures
UNIT III - AIRCRAFT ENGINE : JET ENGINE Field visit to different Organisations.**		25 Lectures

**** Please refer Appendix1 for Format for the report from the students after the field visit**

Course Code		Credits
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USARM5P2	(PRACTICALS) AIRCRAFT ELECTRICITY AND ELECTRONICS	2 Credits (70 lectures)
	(PRACTICALS) DIGITAL TECHNIQUES, COMPUTERS AND INSTRUMENTS	
Unit I - AIRCRAFT ELECTRICITY AND ELECTRONICS : 1. Identification of various components of electrical power distribution system on aircraft (Lear Jet) 2. Explanation regarding the precautions to be observed while working on aircraft and in particular while working on electrical system. 3. Practical on D.C generator installed on aircraft such as identification of connections, cleaning of wire bundles, checking the routing and screening of wire bundles in an aircraft, cleaning of generator etc. 4. Tracing of aircraft wiring circuits with the help of wiring diagram. 5. Using schematic diagrams 6. Identification of location of various electrical components on aircraft. 7. Use of inspection schedules. 8. Purpose of built- in test equipments (BITE check) 9. Checking the serviceability of static dischargers etc.		25 Lectures
Unit II - DIGITAL TECHNIQUES AND INSTRUMENTS : 1. Study of JK-Flip Flop circuit and seven segment decoder driver. 2. Study of basic computer, MS word, Excel 2007 for windows. 3. Introduction to hyper text mark up language. 4. Demonstrate operation of microprocessor 8085 trainer kit and verify ADC 0809 function. 5. To verify programme for rolling display on LCD (using 8085 trainer kit). 6. Hexa decimal addition of two numbers , decimal addition of two numbers the result of which should not be greater than 199 (using 8085 trainer kit).		20 Lectures
UNIT III - AIRCRAFT INSTRUMENT SYSTEM : 1. Measurement of cylinder head temperature with thermocouple principle mockup. 2. Measurement of engine speed with tachometer principle mockup. 3. Compass Swinging procedure. 4. Practice of connecting primary control surfaces to control column through the linkages and their operation. 5. Leak test of ASI mockup. 6. Measurement of pressure with the help of U tube manometer. 7. Familiarization, calibration and bench test of ASI, altimeter, VSI.		25 Lectures

SCHEME OF EXAMINATION

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Sem End	Internal		Written	Sem End
USARM 501	AIRCRAFT STRUCTURE SYSTEMS: AIRCRAFT PRESSURISATION AND AIR CONDITIONING	60	40	--	--	100	2 Hrs.	--
USARM 502	AIRCRAFT ELECTRICITY AND ELECTRONICS	60	40	--	--	100	2 Hrs.	--
USARM 503	DIGITAL TECHNIQUES AND INSTRUMENTS	60	40	--	--	100	2 Hrs.	--
USARM 504	THEORY OF FLIGHT & AIRCRAFT FLIGHT CONTROLS	60	40	--	--	100	2 Hrs.	--
USARM 505	AIRCRAFT ENGINES (PISTON/JET)	60	40	--	--	100	2 Hrs.	--
USARM 5P1	AIRCRAFT STRUCTURE SYSTEMS: AIRCRAFT PRESSURISATION AND AIR CONDITIONING	--	--	100	--	100	--	4 Hrs.
	AIRCRAFT ENGINE (PISTON/JET)							
USARM 5P2	AIRCRAFT ELECTRICITY AND ELECTRONICS	--	--	100	--	100	--	4 Hrs.
	DIGITAL TECHNIQUES AND INSTRUMENTS							
Total						700		

EVALUATION PATTERN

Theory Evaluation

Internal 40Marks	Semester End 60 Marks	Duration 2 Hrs	Marks 100
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Internal Evaluation - For Theory

Sr No	Particulars	Marks
1.	One Class Test/Case Study/Online examination conducted in the given semester.	20 Marks
2.	One Assignment based in curriculum to be assessed by the teacher concerned.	10 Marks
3.	Active participation in routine class instructional deliveries.	05 Marks
4.	Overall conduct as a responsible learner, communication and leadership qualities in organizing related academic activities.	05 Marks

Semester End - Exam

In Each Paper

Q. No.	Unit	Max Marks	Marks with Internal Option
1	1	15	30
2	2	15	30
3	3	15	30
4	1,2,3	15	30
Total		60	120

All Questions Compulsory

Practical Evaluation :-

External Examination

Semester End : 100 Marks

Duration : 4 Hrs_

Sr. No.	Particulars for External Practical Examination		Marks
1.	Semester End Practical Examination		100 Marks
	Laboratory Work	80 Marks	
	Journal	10 Marks	
	Viva	10 Marks	

REPORT ON FIELD VISIT

NAME OF STUDENT:

BATCH :

ROLL No.:

NAME OF THE ORGANISATION VISITED:

DATE:

TIME:

SHOP VISITED:

REPORT OF VISIT:

Topics related to your studies or courses

Literature

Observation

Analysis

Inferences

Knowledge gain

COMMENTS/SUGGESTIONS:

Signature:

Student

Instructor

T.Y.B.Sc. AERONAUTICS (MECHANICAL STREAM) Syllabus**Credit Based and Grading System****To be implemented from the Academic year 2013-2014****SEMESTER VI (20 Weeks)****THEORY**

Course Code	UNIT	TOPICS	Credits	L / Week
USARM601	I	Aircraft Structure Systems (Mechanical) Snag analysis and Rectification	2	3
	II	Aircraft Structure Systems (Avionics) Snag analysis and Rectification		
USARM602	I	Aircraft Engine & Engine Fuel system – Repair, Maintenance.	2	3
	II	Ground Handling, Documentation		
PRACTICALS				
USARM6P1	Aircraft Structure Systems (Mechanical) Snag analysis and Rectification		4	6
USARM6P2	Aircraft Engine & Engine Fuel system – Repair, Maintenance.		4	6
USARM6P3	Aircraft Structure Systems (Avionics) Snag analysis and Rectification		4	6
USARM6P4	Ground Handling, Documentation		4	8

SEMESTER VI (20 Weeks)

Course Code		Credits
USARM601	Aircraft Structure Systems (Mechanical) Snag analysis and Rectification & Aircraft Structure Systems (Avionics) Snag analysis and Rectification (THEORY)	2 Credits (60 lectures)
Unit I : Aircraft Structure Systems (Mechanical) Snag analysis and Rectification: The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft structure systems: namely Hydraulics, Pneumatics, Ice & rain protection, Landing gear, Oxygen, Fire protection, Air conditioning & cabin pressurization. The snag analysis and rectification.		30 Lectures
Unit II: Aircraft Structure Systems (Avionics) Snag analysis and Rectification. The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft structure systems namely Electrical, Instrument, Radio and Digital. The snag analysis and rectification.		30 Lectures

Course Code		Credits
USARM602	Aircraft Engine & Engine Fuel system – Repair, Maintenance, Ground Handling & Documentation. (THEORY)	2 Credits (60 lectures)
Unit I : Aircraft Engine & Engine Fuel system – Repair, Maintenance The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft structure systems namely Aircraft engines, Fuel system, Fuel metering system, Lubrication system. The snag analysis and rectification.		30 Lectures
Unit II : Ground Handling, Documentation Ground handling and ground support and safety equipments; Engine starting precautions; Propeller and Turbine Engines; Hot and hung starts; Use of ground equipment for hydraulic power, air-conditioning, Electrical Power, Fuelling of aircraft, Precautions for servicing oil or fuel; Servicing Oxygen system; Lashing and mooring of light and heavy aircraft; Taxiing and Marshalling, Jacking of aircraft; Cold weather handling.		30 Lectures

Course Code		Credits
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USARM6P1	(PRACTICALS ON SNAGS) Aircraft Structure Systems (Mechanical) Snag analysis and Rectification	4 Credits
i) Hydraulic quantity low ii) Flight Controls not operating iii) Brakes not getting applied iv) Emergency air brakes not working v) Ice formation in engine inlet vi) Windshield wipers not working vii) Landing Gear warning light ON viii) Low oxygen pressure ix) Engine fire extinguisher system unserviceable x) Cabin pressure low xi) Cabin temperature high		100 Lectures

USARM6P2	(PRACTICALS ON SNAGS) Aircraft Engine & Engine Fuel system – Repair, Maintenance.	4 Credits
i) No start, No light up, No EGT rise. ii) Slow start. iii) Hung start. iv) Hung up at low speed – less than 30%. v) Hung up at 50% N2 – High EGT. (Hot start). vi) Stall. vii) Flame out or power loss. viii) Stall – Surge. ix) Parameter fluctuation. x) High Oil Consumption (HOC). xi) Oil from Drain Mast – no other leak. xii) Oil wetting in fan cowl & Accessory Gear Box (AGB).		100 Lectures

Course Code		Credits
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USARM6P3	(PRACTICALS) Aircraft Structure and Systems (Avionics) snag analysis and rectification	4 Credits
	<ol style="list-style-type: none"> 1. Removal and installation of static port. 2. Functional test of oil pressure transmitter. 3. Oil pressure switch and transmitter removal and installation. 4. Pitot system leakage check. 5. Static system leakage check. 6. Stall warning system functional test. 7. Operational check of wing low fuel warning light system. 8. Practical on energizing power on aircraft. 9. Practical on DC power distribution of system in aircraft. 10. Practical on aircraft lighting system. 11. Practical on aircraft bonding system. 12. Practical on identification of cables and wire in aircraft. 13. Practical on removal and fitting of landing lights, taxiing lights and anti collision lights. 14. Inspection and repair of AC equipment mounting, wiring . 15. Operating/repair procedure for VHF com and selcal. 16. Familiarization of ESDS equipment handling, transportation and interchange. 17. Familiarization of Data bus test equipment. 18. Familiarization of CMC for check and trouble shooting of system. 	100 lectures

USARM6P4	(PRACTICALS) Ground Handling, Documentation	4 Credit
	<ol style="list-style-type: none"> 1) Name the various equipments and supports used for a) Ground Handling b) Ground support and c) safety equipments 2) Enumerate the precaution needed for engine starting 3) What are engine a) Hot Start b) Hung Start 4) How is refueling done and various precautions required for that 5) Describe servicing of oxygen system 6) Draw and explain different methods of mooring an a/c 7) Explain Taxing and the various signals for marshalling. 8) Draw and explain jacking of a/c 9) Explain how a/c handling is done in cold weather. <p>DOCUMENTATION OF ALL PRACTICALS</p>	120 lectures

SCHEME OF EXAMINATION

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Sem End	Internal		Written	Sem End
USARM 601	Aircraft Structure and Systems (Mechanical) snag analysis and rectification	60	40	--	--	100	2 Hrs.	--
	Aircraft Structure and Systems (Avionics) snag analysis and rectification							
USARM 602	Aircraft Engine & Engine Fuel system – Repair, Maintenance.	60	40	--	--	100	2 Hrs.	--
	Ground Handling, Documentation							
USARM 6P1	Aircraft Structure and Systems (Mechanical) snag analysis and rectification	--	--	100	--	100	--	4 Hrs.
USARM 6P2	Aircraft Engine & Engine Fuel system – Repair, Maintenance.	--	--	100	--	100	--	4 Hrs.
USARM 6P3	Aircraft Structure and Systems (Avionics) snag analysis and rectification	--	--	100	--	100	--	4 Hrs.
USARM 6P4	Ground Handling, Documentation	--	--	200	--	200	--	6 Hrs
Total						700		

EVALUATION PATTERN

Theory Evaluation

Internal 40Marks	Semester End 60 Marks	Duration 2 Hrs	Marks 100
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Internal Evaluation - For Theory

Sr No	Particulars	Marks
1.	One Class Test/Case Study/Online examination conducted in the given semester.	20 Marks
2.	One Assignment based in curriculum to be assessed by the teacher concerned.	10 Marks
3.	Active participation in routine class instructional deliveries.	05 Marks
4.	Overall conduct as a responsible learner, communication and leadership qualities in organizing related academic activities.	05 Marks

Semester End - Exam

In Each Paper

Q. No.	Unit	Max Marks	Marks with Internal Option
1	1	15	30
2	2	15	30
3	3	15	30
4	1,2,3	15	30
Total		60	120

All Questions Compulsory

Practical Evaluation :- of USARM6P1, USARM6P2 ,USARM6P3 &USARM6P4

External Examination: - For each Practical Course -

USARM6P1, USARM6P2 & USARM6P3

Semester End : 100 Marks

Duration : 4 Hrs_

Sr. No.	Particulars for External Practical Examination		Marks
1.	Semester End Practical Examination		100 Marks
	Laboratory Work	80 Marks	
	Journal	10 Marks	
	Viva	10 Marks	

External Examination :- For Practical Course - USARM6P4

Semester End : 200 Marks

Duration : 6 Hrs_

Sr. No.	Particulars for External Practical Examination		Marks
1.	Semester End Practical Examination		200 Marks
	Laboratory Work	160 Marks	
	Journal	20 Marks	
	Viva	20 Marks	