AC 27/2/13
Item No. 4.4

UNIVERSITY OF MUMBAI

Syllabus for Sem V & VI
Program: B.Sc.
Course: AERONAUTICS
(AVIONICS STREAM)

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

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

SEMESTER V (20 Weeks)

THEORY

Course Code	UNIT	TOPICS	Credits	L / Week
USARA501	I II III	ENGINE IGNITION SYSTEM : JET ENGINE AND PISTON ENGINE	3	4
USARA502	I II III	AIRCRAFT ELECTRICAL SYSTEM	3	4
USARA503	I II III	DIGITAL ELECTRONICS AND COMPUTERS	3	4
USARA504	I II III	AIRCRAFT RADIO COMMUNICATION	3	4
USARA505	I II III	AIRCRAFT INSTRUMENT SYSTEM	3	4
PRACTICALS				
USARA5P1	ENGINE IGNITION SYSTEM : JET ENGINE ENGINE IGNITION SYSTEM : PISTON ENGINE AIRCRAFT INSTRUMENT SYSTEM		2	4
USARA5P2	AIRCRAFT ELECTRICAL SYSTEM DIGITAL ELECTRONICS AND COMPUTERS AIRCRAFT RADIO COMMUNICATION		3	6

SEMESTER V (20 Weeks)

Course Code		Credits
USARA501	**ENGINE IGNITION SYSTEM : JET ENGINE AND PISTON ENGINE. (THEORY)**	**3 Credits (70 lectures)**
Unit I : Jet engine ignition systems Main ignition systems, Continuous duty circuit, Auto ignition, precautions to be observed while handling ignition system, Joule ratings, Intermittent duty low tension ignition system with low DC voltage input .		**25 Lectures**
Unit II : Jet engine ignition systems High tension intermittent duty AC ignition system, AC versus DC input system, High tension ignition system, Igniter plugs , maintenance of igniter plugs, Trouble shooting of ignition system.		**20 Lectures**
Unit III : Piston engine ignition systems Types of ignition systems, Extended duty low tension ignition system, High tension ignition system, spark igniters, Glow plug igniters, maintenance of spark plugs, Trouble shooting of ignition system.		**25 Lectures**
Reference Book:- Aircraft Gas Turbine Power Plants by C.E. Otis & Peter A. Vosbury – Chap 11. Aircraft Gas Turbine Engine Technology by Irwin E. Treager – Chap 16.		

Course Code		Credits
USARA502	**AIRCRAFT ELECTRICITY & ELECTRONICS (THEORY)**	**3 Credits (70 lectures)**
Unit I : Aircraft electrical power distribution systems, general requirements of power distribution systems, need for protective devices , electrical load , electrical load analysis, a simple electrical system, Main power distribution systems, single engine aircraft, twin engine aircraft, power distribution on composite aircraft, large aircraft electrical systems, The split –bus system, parallel electrical systems ,split parallel system , DC electrical systems , power distribution hierarchy, Control of power distribution systems, current trans-formers		**25 Lectures**
Unit II : Design and maintenance of aircraft electrical systems, requirements for electrical systems, general requirements , requirements for transport aircraft, typical schematic diagrams, Identification systems for locating electrical components aircraft lights, position lights, anti- collusion lights ,landing lights , instrument lights , warning lights, landing gear circuits ,large aircraft electrical systems, lighting circuits ,Flight compartment lights passenger compartment lights ,general lighting systems landing gear control circuits ,built in test equipments electronic control units ,equipment cooling, static dischargers,		**20 Lectures**
Unit III : Maintenance and troubleshooting of electrical system, general requirements, inspection schedule, Multi meter trouble shooting ,volt meter trouble shooting , voltmeter and composite aircraft , ohmmeter trouble shooting, 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 T.K.Eismin, R.D.Bent &J.L.Mckinley – Chap :- 1i &12. Aircraft Electricity System by E.H.J. Pallet- Chap :- 2,4,5,7 & 8.		

Course Code		Credits
USARA503	**DIGITAL ELECTRONICS AND COMPUTERS (THEORY)**	**3 Credits (70 lectures)**
Unit I : Digital data transfer system, ARINC 429,629, bus system, fiber optic system, Advantages, disadvantages, operation, system details. ESDS equipment handling, storage, precautions. EMI – Electro Magnetic Interference, sources, effects, prevention, electro magnetic compatibility. Software management.		**20 Lectures**
Unit II: Computers – types, description, function of hardware, languages, machine language, simple programming. Assembly language, Use of World Wide Web.		**25 Lectures**
Unit III : Micro processor -Operation of various registers, CPU, I/O, interfacing, data buses, programming using 8085.		**25 Lectures**
Reference Book : Fundamentals of Microprocessors and Micro computers –by B Ram. Aircraft Digital Electronics and Computer System by Mike Tooley – Chap:- 4,6,7,10,12,13 &14.		

Course Code		Credits
USARA504	**AIRCRAFT RADIO COMMUNICATION (THEORY)**	**3 Credits (70 lectures)**
Unit I: VHF Omni range Nav System, Microwave Landing System, VLF /Omega Navigation system, LORAN Navigation system, Area Navigation System.		**25 Lectures**
Unit II: TCAS, ATC transponders, Weather Radar System, Radio Altimeter, Arinc Communication & reporting.		**20 Lectures**
Unit III: GPWS, Audio Integration System, Principles of Satellite communication, GPS, GLONASS.		**25 Lectures**
Reference Book : Avionics Fundamentals by Jeppesen – Chap:- 9,10,12,15,18,&24. Aircraft Communication and Navigation System by Mike Tooley & D.Wyatt – Chap :- 9,10,13,14,16,18,20,21&22. Aircraft Radio Systems by James Powell – Chap :- 4,6,7,8,9,10.11&12 Avionics Training by Len Buckwalter – Chap :- 5,6,9,11,14,15,16,19&20.		

Course Code		Credits
USARA505	**AIRCRAFT INSTRUMENT SYSTEM (THEORY)**	**3 Credits (70 lectures)**
Unit I: Electronic display, EFIS (Electronic flight instrument system), Electronic Instruments for Engine & Airframe system control, EICAS(Engine indicating and crew alerting system), ECAM (Electronic centralized aircraft monitoring .		**25 Lectures**
Unit II: Auto throttle system, INS/IRS(Inertial reference system),Stall warning system.		**20 Lectures**
Unit III: Flight Data Recorder System, Flight management system, Maintenance , Trouble shooting.		**25 Lectures**
Reference Book : Aircraft Instrument and Integrated System(4th Edition)E.H.J.Pallet :- Chap 11,12,13,14,15,16 & 17 Avionics Training: Systems, Installation and Trouble Shooting by Len Buckwalter :- Chap. 18		

Course Code		Credits
USARA5P1	**(PRACTICALS)** • **ENGINE IGNITION SYSTEM.** • **AIRCRAFT INSTRUMENT SYSTEM**	**2 Credits** **(60 lectures)**
UNIT I: **Ignition system - Jet Engine** 1.Name the components used in ignition system on the engine. Give their purpose and location. 2.Name and locate the different switches in the cockpit relating to ignition system of jet engine. When and how are these switches used? 3.Draw and explain the purpose and construction of igniter plugs. Give the number and location of these igniter plugs on engine. 4.Give the different types of electrical power supply to ignition system on aircraft and where are these located? What type is the battery and how is it serviced? 5.How is ignition system checked/ tested on aircraft and engine. 6.How are igniter plugs inspected/ serviced? What precautions are necessary while handling the igniter plugs on ignition system? How are the igniter plugs disposed if unserviceable? 7.Which portion of ignition system, wiring is radio shielded, why and how?		**20Lectures**
UNIT II: **Ignition system - Reciprocating Engine(Piston Engine)** 1. Name the different components used on ignition system. Give their purpose, location and number. 2. Explain with diagram the construction and working of magneto. 3. How are the magnetos serviced and their timing adjusted 4. Draw and explain the construction of a spark plug. Give their number and location 5. How are spark plugs inspected, serviced and rotated. 6. How is harnesses constructed. Why and how are these radio shielded? 7. Draw and explain the purpose of a booster coil. Give their number and location		**20Lectures**
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.		**20Lectures**

Course Code		Credits
USARA5P2	**(PRACTICALS)** • **AIRCRAFT ELECTRICITY & ELCTRONICS** • **DIGITAL ELECTRONICS & COMPUTERS** • **AIRCRAFT RADIO COMMUNICATION**	**3 Credits** **(90 lectures)**
Unit I: AIRCRAFT ELECTRICITY & ELCTRONICS 1. Practicals on demonstration of general electrical distribution system such as DB, JB, CB, fuses etc, Methods used for identification of the cable, plugs, sockets, wire and cable looms etc. 2. Familiarization with securing of cable looms on aircraft. 3. Familiarization with securing of cable looms on aircraft. 4. Familiarization with aircraft warning lights and navigation lights, anti-collision lights and strobe lights etc. 5 Familiarization with equipments used for voltage control and protection system such as voltage regulators, cutouts, equalizing circuits and current limiters etc. 6. Familiarization with aircraft invertors and its controls 7. Use of aircraft inspection schedules 8. Use of common electrical test requirements for fault analysis on electrical installations. 9. Use of built in test equipments (bite test). 10. Familiarization with aircraft static discharges. 11.Identification of aircraft wires and fault analyzing etc.		**30 Lectures**
Unit II : DIGITAL ELECTRONICS AND COMPUTERS 1. Study the performance of semi conductor diode, transistors applications. 2. Study of basic computer, basic MS word 2007 for windows. 3. Study of basic micro soft , Excel 2007 for windows. 4. Study of basic power point 2007 for windows. 5. Introduction to hyper text mark up language. 6. Demonstrate operation of microprocessor 8085 (trainer kit) and verify ADC 0809 function. 7. Verify programme for rolling display on LCD using trainer kit 8085.		**30 Lectures**
Unit III: AIRCRAFT RADIO COMMUNICATION 1. Study the operation of basic transmitter and receiver. 2. Familiarization of tools used for repair of cables, replacement of connectors. 3. Identify components and testing of communication system. 4. Identification and familiarization of weather radar system .		**30 Lectures**

SCHEME OF EXAMINATION

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Sem. End	Internal		Written	Sem.. End
USARA 501	Aircraft Fuel system and Engine Ignition system.	60	40	--	--	100	2 Hrs.	--
USARA 502	Aircraft Electrical System	60	40	--	--	100	2 Hrs.	--
USARA 503	Digital Electronics	60	40	--	--	100	2 Hrs.	--
USARA 504	Aircraft Radio Communication	60	40	--	--	100	2 Hrs.	--
USARA 505	Aircraft Instrument System	60	40	--	--	100	2 Hrs.	--
USARA 5P1	Aircraft Fuel system and Engine Ignition system. Aircraft Instrument System	--	--	100	--	100	--	4 Hrs.
USARA 5P2	Aircraft Electrical System Digital Electronics Aircraft Radio Communication	--	--	100	--	100	--	4 Hrs.
Total						**700**		

EVALUATION PATTERN

Theory Evaluation

Internal	Semester End	Duration	Marks
40Marks	60 Marks	2 Hrs	100

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	

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SEMESTER VI (20 Weeks)

THEORY

Course Code	UNIT	TOPICS	Credits	L / Week
USARA601	I	AIRCRAFT ELECTRICITY: SNAG ANALYSIS & RECTIFICATION	2	4
	II	AIRCRAFT INSTRUMENT: SNAG ANALYSIS & RECTIFICATION		
USARA602	I	DIGITAL ELECTRONICS & COMPUTERS: SNAG ANALYSIS & RECTIFICATION	2	4
	II	AIRCRAFT RADIO NAVIGATION: SNAG ANALYSIS & RECTIFICATION		
USARA603	I	GROUND HANDLING AND DOCUMENTATION	2	4
PRACTICALS				
USARA6P1		AIRCRAFT ELECTRICITY SNAG ANALYSIS & RECTIFICATION	5	10
		INSTRUMENT SNAG ANALYSIS & RECTIFICATION		
USARA6P2		DIGITAL ELECTRONICS & COMPUTERS SNAG ANALYSIS & RECTIFICATION	5	10
		RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION		
USARA6P3		GROUND HANDLING AND DOCUMENTATION	4	9

SEMESTER VI (20 Weeks)

Course Code		Credits
USARA601	**AIRCRAFT ELECTRICITY, AIRCRAFT INSTRUMENT SNAG ANALYSIS & RECTIFICATION, GROUND HANDLING AND DOCUMENTATION (THEORY)**	**2 Credits (40 lectures)**
Unit I : AIRCRAFT ELECTRICITY ANALYSIS & RECTIFICATION The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft Electrical systems. The snag analysis, reason finding and rectification required.		**20 Lectures**
Unit II : AIRCRAFT INSTRUMENT SNAG ANALYSIS & RECTIFICATION The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft Instrument systems. The snag analysis, reason finding and rectification required.		**20 Lectures**

Course Code		Credits
USARA602	**DIGITAL ELECTRONICS & COMPUTERS, RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION (THEORY)**	**2 Credits (40 lectures)**
Unit I: DIGITAL ELECTRONICS SNAG ANALYSIS & RECTIFICATION The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft Digital Technology. The snag analysis, reason finding and rectification required.		**20 Lectures**
Unit II: RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION The snags in the aircraft systems pertaining to syllabus covered in Semester 1 to Semester 5 for Aircraft Radio communication systems. The snag analysis, reason finding and rectification required.		**20 Lectures**

Course Code		Credits
USARA603	**GROUND HANDLING AND DOCUMENTATION (THEORY)**	**2 Credits (40 lectures)**
	Ground handling and ground support and safety equipment's; Engines 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 in servicing oil or fuel; servicing Oxygen system; Lashing and mooring of light and heavy aircraft; Taxing and marshalling, Jacking of aircraft; Cold weather handling. Documentation of all practicals.	**40 Lectures**

Course Code		Credits
USARA6P1	**(PRACTICALS)** **AIRCRAFT ELECTRICITY SNAG ANALYSIS & RECTIFICATION** **(PRACTICALS)** **INSTRUMENT SNAG ANALYSIS & RECTIFICATION**	**5 Credits** **(150 lectures)**
UNIT I: AIRCRAFT ELECTRICITY SNAG ANALYSIS & RECTIFICATION – 1.Practicals on defect rectification of aircraft power supply system such as GPU not Getting connected to aircraft. Low battery voltage, ground relay chattering etc . 2. Practicals on defect rectification on aircraft power supply distribution system such as voltage regulators malfunctioning, adjustment of voltage on aircraft etc. 3. Praticals on defect rectification on navigation, anti-collision and landing lights etc. 4. Practicals on inverter circuits, main inverter, standby and emergency inverter 5. Practicals on removal, inspection and fitting of anti-collision lights. 6.Practicals on servicing of GPU, charging, cleaning, checking of electrolyte level and specific gravity. 7. Checking the serviceability, inspection, removal and fitting of landing lights and taxiing lights etc.		**75 Lectures**
UNIT II: INSTRUMENT SNAG ANALYSIS & RECTIFICATION – 1. Operational check of wing low fuel warning light system 2. Fuel quantity indicator calibration 3. Removal & installation of Thermo-couple harness 4. Resistance and Insulation check of thermo-couple harness and its leads 5. Adjusting and Testing of EGT indicating system 6. Removal and installation of static port 7. Functional Test of Oil Pressure Transmitter 8. Oil Pressure Transmitter Test & Adjustment 9.Oil pressure switch & transmitter removal & installation 10. Pitot system leakage check 11. Altitude pressure switch functional test 12. Calibration of Flux valve – Directisyn 13. Fuel flow transmitter removal and installation 14. Fuel flow indicator adjustment 15. Compensation of Magnetic Compass 16. Static system leakage check 17. Stall warning system functional test 18. Location , Identification and operation of RAT indicating system 19. Battery connection and voltage check 20. Opening & Closing of Main Door		**75 Lectures**

Course Code		Credits
USARA6P2	**(PRACTICALS)** **DIGITAL ELECTRONICS & COMPUTERS SNAG ANALYSIS & RECTIFICATION**	**5 Credits** **(160 lectures)**
	(PRACTICALS) **RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION**	
Unit I: DIGITAL ELECTRONICS SNAG ANALYSIS & RECTIFICATION 1. To verify the digital data transfer is valid and analyse if any defect is detected using simulated testing. 2. To verify the ATC transponder code is valid and test the altimeter digital encoding is correct using simulated test procedure. 3. To check operation of ELT and detect 15 digit code and also how to proceed further for snag rectification, if necessary. 4. Snag rectification of digital radio altimeter system. 5. Avionic system check and repair using central maintenance computers provided in aircraft. 6. Carry out different programs on microprocessor 8085 computers and basic trouble shooting.		**80 Lectures**
Unit II: RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION 1. Inspection/ repair of aircraft equipment mounting racks, wiring . 2. Rectification of snag:- intermittent reception/ noisy reception 3. Testing procedure for ADF system of aircraft. 4. Procedure for testing emergency locator beacon 5. Operational check of instrument landing system 6. Operation test of aircraft Traffic control system 7. Operational check of DME (Distance Measuring Equipment) system. 8. Operation check of radio altimeter. 9. Operational check of Very High Frequency omni range (VOR) system. 10. Snag rectification:- Jamming of VHF channel. 11. Rectification of snag:- Audio low, intermittent, while testing/ using communication system . 12. Rectification of VHF transmission:- intermittent, poor.		**80 Lectures**

USARA6P3	**(PRACTICALS)** **GROUND HANDLING AND DOCUMENTATION**	**4 Credit** **(120 lectures)**
	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. **DOCUMENTATION OF ALL PRACTICALS**	**120 lectures**

SCHEME OF EXAMINATION

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Sem. End	Internal		Written	Sem. End
USARA 601	AIRCRAFT ELECTRICITY SNAG ANALYSIS & RECTIFICATION INSTRUMENT SNAG ANALYSIS & RECTIFICATION	60	40	--	--	100	2 Hrs.	--
USARA 602	DIGITAL ELECTRONICS SNAG ANALYSIS & RECTIFICATION RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION	60	40	--	--	100	2 Hrs.	--
USARA 603	GROUND HANDLING AND DOCUMENTATION	60	40	--	--	100	2 Hrs.	--
USARA 6P1	AIRCRAFT ELECTRICITY SNAG ANALYSIS & RECTIFICATION INSTRUMENT SNAG ANALYSIS & RECTIFICATION	--	--	100	--	100	--	4 Hrs.
USARA 6P2	DIGITAL ELECTRONICS SNAG ANALYSIS & RECTIFICATION RADIO NAVIGATION SNAG ANALYSIS & RECTIFICATION	--	--	100	--	100	--	4 Hrs.
USARA 6P3	GROUND HANDLING AND DOCUMENTATION	--	--	200	--	200	--	6 Hrs
Total						**700**		

EVALUATION PATTERN

Theory Evaluation

Internal	Semester End	Duration	Marks
40Marks	60 Marks	2 Hrs	100

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 USARA6P1, USARA6P2 &USARA6P3

External Examination: - For each Practical course - USARA6P1 &USARA6P2

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 - USARA6P3

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	