Academic Council 25/05/2011
Item No. 4.49

UNIVERSITY OF MUMBAI

Syllabus for the F.Y.B.Sc.
Program: B.Sc.
Course : AERONAUTICS
(Mechanical Stream)

(Credit Based Semester and Grading System with effect from the academic year 2011–2012)

PREAMBLE

NEED FOR LAUNCHING AERONAUTICS COURSE :

a) To provide capable and trained persons to Aviation Industry.

b) To fulfill the minimum academic qualification requirement so as to enable the graduates to compete for higher positions in the Aviation Industry.

The Aviation Industry is poised for substantial growth in India and this will go a long way for the country's overall development to be maintained at a high rate. The country has already witnessed the Open skies policy which led to significant increase in Air services which in turn required parallel growth in infra-structure. The need of the future, therefore will be felt in much greater requirement of skilled manpower in all streams connected with Aviation like management of increased number of airplanes and their maintenance. The movement of goods and people will have to be quick and this can only be achieved by an efficient, reliable and economic aviation industry. The industry therefore needs more and more aircraft and large workforce to keep them flying safely.

The Syllabus of B.Sc. (Aeronautics) degree is designed to enable the student to acquire the necessary qualification to enter into the Job market in any of the related fields of Aviation such as Traffic Control, Crew and Man power Scheduling, In-flight service department, Security, Civil Works department and Line and Major maintenance department of Engineering etc. The existing highly qualified work force of AMEs (Aircraft Maintenance Engineers) shouldering huge responsibility in the certification of an Aircraft carrying large number of passengers say 400 to 500 passenger capacity, are denied the higher positions in the Industry merely for not possessing Graduate degree in Aeronautics.

After obtaining B.Sc. degree in Aeronautics student may start his career as Trainee Technician with some stipend and then as Jr. Technician with salary of about Rs. 20,000 /- to Rs. 25,000/-. Further promotional avenues could be Sr. Technician, Charge hand, etc. depending on his achievements. The undergraduate study will significantly enhance the competency of the student to appear in the AME (Aircraft Maintenance Engineer) license examination conducted by DGCA (Director General of Civil Aviation).

After acquiring License qualification he can start his career as Aircraft Maintenance Engineer category and he may draw salary in the range of Rs. 55,000/- to 3,00,000/- per month depending upon his achievements and qualifications.

However, it is also possible that the graduates (B.Sc Aeronautics) enter the field of Non-Technical streams in the Aviation Industry like Commercial Dept., In-flight service Dept., Ground Support Dept., Security Dept. etc. where the starting salary would be about Rs. 20,000/- rising to six figures.

It is, therefore, in fitness of things that such a degree course would help the student to make his career in Aviation.

Note : The eligibility to enroll in DGCA approved AME Course is 10 + 2 with 50% aggregate in Physics & Mathemetics. However, the student joining the B.Sc. Aeronautics Course with lesser marks in 10 + 2 (45% or 40%) can also qualify for AME licence by fulfilling the experience requirement of DGCA.

O.5962 Title:-BACHELOR OF SCIENCE IN AERONAUTICS - (MECHANICAL)

O.5963 Eligibility : HSC (10 + 2) of MSBHSC or equivalent of any other Government state board with minimum 45% marks in aggregate (40% for reserve category) with English, Physics and Mathematics subjects

OR

Diploma (10 + 3) awarded by MSBTE or equivalent by any other Government body in following branches of engineering.

i) Mechanical

ii) Electronics

iii) Electrical

iv) Computer

v) Information Technology

vi) Automobile

vii) Industrial Electronics

viii) Radio Engineering and Telecommunication

ix) Instrumentation

R.8397 Duration: The Course is for Three years - divided into Six Semesters but not more than Six years.

R.8398 Intake Capacity : B.Sc Aeronautics – Mechanical - 60 students.

R.8399 Fee Structure :

Particulars	Sem. I	Sem. II	Sem. III	Sem. IV	Sem. V	Sem. VI
Tuition Fees	20000	20000	20000	20000	20000	20000
Library Fees	1500	1500	1500	1500	1500	1500
Gymkhana Fees	100	100	100	100	100	100
Other fees/ Extra Curricular Activity	125	125	125	125	125	125
Exam Fees	1000	1000	1000	1000	1000	1000
Enrolment Fees	220	0	0	0	0	0
Disaster relief Fund	10	0	10	0	10	10
Adm. Processing	200	200	200	200	200	200
Utility Fees	125	125	125	125	125	125
Magazine fees	100	0	100	0	100	0
ID Card & Library Fees	50	0	50	0	50	0
Group Insurance Fees ***	250	250	250	250	250	250
Student Welfare fund	25	25	25	25	25	25
Development fees	5000	5000	5000	5000	5000	5000
Vice Chancellor's Fund	20	0	20	0	20	0
Uni. Sports & Culture	30	0	30	0	30	0
E-Suvidha	50	0	50	0	50	0
E-Charges	20	0	20	0	20	0
(A)	28825	28325	28605	28325	28605	28325
Laboratory Fees	7500	7500	7500	7500	7500	7500
(B)	7500	7500	7500	7500	7500	7500
Total of (A) & (B)	36325	35825	36105	35825	36105	35825
Refundable						
Caution Money	2000					
Library Deposit	5000					
Laboratory Deposit	3000					
(C)	10000					
Total of A& B &C	46275	35825	36105	35825	36105	35825
Wherever Applicable						
Transcript	1000	1000	1000	1000	1000	1000
Admin Form	100	100	100	100	100	100
Transfer Certificate	100	100	100	100	100	100
Bonafide Certificate	20	20	20	20	20	20
No Objection Certificate	20	20	20	20	20	20
Industrial Visit Fees	500	500	500	500	500	500
Computer Practical Fees	1000	1000	1000	1000	1000	1000
Alumni Association Fees	25	25	25	25	25	25
Document Verification Fees*	400	400	400	400	400	400
Project Fees	400	400	400	400	400	400
	3565	3565	3565	3565	3565	3565

* - To be charged from students those who are not from MSBHSC.

*** - Rs. 250/- on Rs. 1,00,000/- policy .

Note : Refundable Security Deposit of Rs. 10,000/- which will be refunded after completion of course / after completion of Six years whichever is earlier.

R.8400 Teachers Qualification :

a) having BAMEL (Basic Aircraft Maintenance Engineering License) and at least two years of Aviation Experience of which at least one year in the field of Instruction.

OR

b) Engineering Graduate with at least Two years of Practical experience in Aviation Industry of which at least one year in the field of Instruction.

OR

c) Diploma in Engineering with at least Five years of Practical experience in Aviation Industry of which at least one year in the field of Instruction.

Shop Supervisors : 07

Year	New Appointments	Total Appointments
1st year	02	02
2nd year	05	07

a) at least Five years of Aviation Experience as a Technician of which at least 01 year in the Workshop for Major Maintenance.

OR

b) Diploma in Engineering with more than Five years of Practical experience in Aviation Industry

R.8401 Scheme of Examination

Every course in the Semester will have two unit tests, each after Six weeks of training.

Every Course will have a Semester examination at the end of the Semester. The Written paper will be for 60 marks and Internal assessment will be for 40 marks.

Internal assessment : Theory		
Unit Test (To) -	10 marks each	- 20 marks
Assignments	10 marks	- 10 marks
Viva	10 marks	- 10 marks
Total		- 40 marks

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

Internal assessment : Practical

Best of Five	-	10 marks
Work Culture-		05 marks
Journal work -		05 marks
Total	-	20 marks

R.8402 **Standard of Passing:-** The Passing percentage for the Course is 40%. The candidate should score 40% in individual examination of the Course i.e. Theory & Practical (as applicable) examination.

Examination	Maximum Marks		Minimum Marks for passing		Total
	Written / Task	Internal Assessment	Written / Task	Internal Assessment	
Theory	60	40	24	16	40
Practical	30	20	12	08	20

Note: The Syllabus for the each Semester can be completed in at-least 20 weeks of Theory & Practical training. The hands-on training can be given only in the Aviation Organisation.

Theory / Practical : 20 weeks.

Unit tests : Every course in the Semester will have Two unit tests, each after Six weeks of training for the course. It will take Two weeks cumulative. One week for Final Semester Examination.

SEMESTER I (Mechanical Stream)

		Class room Instruction face to face						Notional				Credits			
Course Code	Title of the Course	Per week			Per semester hours										
		L	P	T	L	P	T	L	P	T	TOTAL	L	P	T	TOTAL
USARM 101	Civil Aviation Legislation to cover CAR Series A to J and Human factor.	6	-	6	120	-	120	120	-	-	240	4	-	-	4
USARM 102	General Engineering to cover Physics & Maths.	4	3	7	90	60	150	40	-	-	190	2	2	-	4
USARM 103	Maintenance Practices & Hardware	5	2	7	100	30	130	40	-	-	170	2	3	-	2
USARM 104	Electrical & Electronic Fundamentals.	6	1	7	120	30	150	40	-	-	190	2		-	5
USARM 105	Engineering Drawing	1	5	6	15	90	105	15	-	-	120	3	2	-	5
	Communication Skill	2	-	2	40	-	40	40	-	-	80				
Total		**24**	**11**	**35**	**485**	**210**	**695**	**295**	**-**	**-**	**990**	**13**	**7**	**-**	**20**

L – Lecture for period of One hour P – Practical T – Tutorial

SEMESTER II (Mechanical Stream)

		Class room Instruction face to face						Notional				Credits			
Course Code	Title of the Course	Per week			Per semester hours										
		L	P	T	L	P	T	L	P	T	TOTAL	L	P	T	TOTAL
USARM 201	Civil Aviation Regulations Series K- X, Advisory Circulars, CAR – 145	6	-	6	120	-	120	120	-	-	240	4	-	-	4
USARM 202	Basics of Aircraft Electricity & Basic Electronics	5	1	6	90	30	120	40	-	-	160	2	2	-	2
USARM 203	Basic Digital Techniques & Basic Aircraft Instruments	5	1	6	100	30	130	40	-	-	170	2		-	4
USARM 204	Workshop Technology, Corrosion, NDT.	5	2	7	90	60	150	20	-	-	190	3	2	-	3
USARM 205	A/c Structure & Systems Paper I : Theory of Flight, Ice & Rain, Hydraulics, Pneumatics.	5	1	6	120	30	150	-	-	-	150	3		-	5
USARM 206	Environmental Studies	1	-	1	30	-	30	30	-	-	60	2	-	-	2
Total		27	5	32	550	150	700	270	-	-	970	16	4	-	20

L – Lecture for period of One hour P – Practical T – Tutorial

Mechanical Stream
(Heavy Aircraft, Jet Engine, Light Aircraft & Piston Engine)
Syllabus as per the Credit System
To be implemented from the Academic year 2011-2012

SEMESTER I

Course Code	Contents	Credits
USARM101	**A) Civil Aviation Legislation** a) Civil Aviation Requirements issued by Director General of Civil Aviation, Ministry of Civil Aviation, Central Govt. of India. Section II, Series A to J. b) Indian Aircraft Rules - 1937 **B) Human factor.** a) Introduction to Human Factor. b) Human performance and limitations c) Social psychology d) Factors affecting performance e) Physical environment	4
USARM102	**General Engineering to cover Physics & Maths.** A) Mass, Centre of Gravity, Work, Energy, Power, Pressure, stress, Torque, Elasticity of Material, Speed, Velocity, Newton's laws of motion, Principle of the Gyroscope. Friction, Viscosity, Fluid Resistance, Specific Gravity, Pressure & Buoyancy in liquids, kinetic Theory of gases, Speed of sound. **B)** Heat & Energy, Conversion, Thermodynamics, Charle's and Boyle's laws, Heat Transfer, Specific Heat, Absolute and relative humidity, Vapour locks, calorific values of fuels. **C)** Dynamics of fluid, Pascal's law & its application in Hydraulic press, Hydraulic and Pneumatic system. Bernoulli's law, Venturi tube theory, Streamline, Laminar and turbulent flow	**4**
USARM103	**Maintenance Practices & Hardware** General safety precautions in the workshop use of simple hand tools & bench work, hammers, mallet, screw drivers, pliers, punch, wrench, special wrench, drills and reamers taps and dies use of cutting instruments Chisel hacksaw.	**2**
USARM104	**Electrical & Electronic Fundamentals.** A) Electron Theory of Electricity, conductors, semi-conductors & insulators. Static electricity. Electric circuits, laws of resistance, effect of temperature with simple calculations. B) Ohm's Law, EMF, arrangement of resistors in series & parallel, Grouping of cells, Internal resistance of a cell, The wheat stone bridge, Kirchoff's Laws & calculations, Faradys law & Lenz's Laws, work energy & power, Faradey's law of electromagnetic induction, eddy current, self & mutual inductance, capacitance in series & parallel combinations & calculations.	**5**

	C) Power source : storage batteries, theory & principle of operations of Lead Acid batteries, construction, battery rating, testing of lead acid batteries, Nickel Cadmium Batteries, principle of operation, construction, charging, testing. **D)** Electric Measuring Instruments : principle of operation of meter movements, Ammeter, voltmeter, shunt, multimeter, meggar, inductive pick up meters. Aircraft electrical wires & wiring practices, characteristics of electrical wires. Bonding and bonding testers, Static dischargers Electrical control devices , switches, circuit barkers, Circuit protective devices, resistors and variable resistors, electro magnets, relays and solenoids etc. Basic Circuit, Analysis and Trouble Shooting.	
USARM105	**Engineering Drawing** Use of Drawing Instruments, Lines & lettering. Construction of parabola, ellipse, hyperbola. First and Third angle projections Technology, orthographic, Isometric oblique perspective. **Communication Skills** Human rights constituents with special reference to Fundamental Rights in India. Importance and benefits of effective communication, concept of communication, Non-verbal communication. Seven C's of effective communication, Professional skill development, reading, writing: – letter writing, report writing, speaking & listening: – discussion, debates.	**5**

SEMESTER II

Course Code	Contents	Credits
USARM201	**A) Civil Aviation Regulations** a) Civil Aviation Requirements issued by Director General of Civil Aviation, Ministry of Civil Aviation, Central Govt. of India. Section II, Series K to X. b) Advisory Circulars, CAR - 66 **B) Human Factor** a) Tasks b) Communication c) Human error d) Hazards in the workplace	4
USARM202	**Aircraft Electricity & Electronics Paper I** a) Alternating Current elementary theory b) Poly phase Systems c) The transformers	2
USARM203	**Digital Techniques & Instruments – Paper I** a) Fundamental laws of Transistors, Introduction to Logic Gates, Application of Logic Gates; Number System b) Requirement & standard location, visibility & grouping of instruments. Methods of display, range, scale & markings. Flight instrument, power plant instrument, methods of mounting panels, illumination of instrument & instrument panels. Instrument mechanism, temperature compensation of instrument mechanism, sealing of instruments. c) Atmospheric pressure & its measurement, mercury barometer, kew barometer, aneroid barometer, U-tube barometer. d) Mechanical instruments: pressure instruments, Bowden tube principle, capsule, diaphragm, bellows. Pitot static system, altimeter, ASI, VSI, Machmeter.	4
USARM204	**A) Workshop Technology** Special purpose bolts, Self locking and non-self locking, Quick release fasteners, Cable fittings, Blind rivets, Pushpull linkages, Snap rings, Bolts and nuts of British manufacture. **B) Corrosion & NDT.** Corrosion : Forms of corrosion, Factors affecting corrosion, Preventive maintenance, Corrosion prone areas, Removal of corrosion and treatment, Mechanical removal of rust, Chemical surface treatment, Removal from highly stressed parts, Sand blasting, Pickling, Light alloys Anodic Oxidation Process : Chromatising	3

USARM205	**A) A/c Structure & Systems Paper I:** Requirements of airplane structure strength, major structural loads and stresses. Fuselage type, Truss monocoque, semi-monocoque & Geodatic. Primary and Auxiliary control surfaces, Static and aerodynamic balance, Fail safe features, Structural failures, Symmetry check, Fuselage construction, **B) Theory of Flight** Thrust, Propulsion, thrust and Momentum, Variation of thrust & Torque, Slipstream, Gyroscopic effect, Swing on takeoff. Level flight, Four forces, conditions of equilibrium, Tail plane, Loads on tail plane, Effect on down wash, Adjustable tail plane, Slab tail plane, Level flight at different air speeds, Relations between airspeed & angle of attack, Effect of height and weight, Flying for maximum range and minimum drag range flying for endurance, Jet aircraft. **C) Ice & Rain Protection** Description and components of a pneumatic de-icing system, installation, Functions of components, Maintenance checks, Thermal anti icing systems, Protection against overheat, Ducting, Windshield icing control system, water and toilet draining heaters, Rain Repellent system and Components, Windshield Wipers. **D) Hydraulic System** Pascal's Law fluids, Components of an aircraft's simple hydraulic system, Fluids lines & fittings, Flexible hoses, Pressure range, material, Components & their functions, Indicating systems, Hydraulic rigs, servicing, Leak checks, internal wear checks. **E) Pneumatic System** Pneumatic systems : High & medium and low pressure systems components, Sources of pressure & control	5
USARM206	**Environmental Studies** Environment composition, Man and Nature relation, Concept of Ecology and Ecosystem, Resources and wealth, exploitation of resources, optimum conservation of resources, Environmental degradation, Disaster Management :– meaning, need, planning & execution.	2

INFRASTRUCTURE:

a) The basic Infrastructure required to start the Course in the Organization, at the start of the Course.

Infrastructure : As per University norms.
Basic Workshop : Having Lathe Machine, Drilling machines, Grinders, Surface table, bench vices etc.
Land area : Sufficient land for building a Hanger for parking the Institution owned aircrafts and Tarmac for giving run up and taxy check of those aircrafts.

The Cost of the above infrastructure and Basic Workshop is Rs. 25,00,000/- (approx. as on date) excluding the cost of land.

b) After starting the Course, the Equipments required in the Organization at the start of Second semester

Laboratory / Workshop :

i) Electrical Workshop
ii) Instrument Workshop
iii) Radio Navigation Workshop
iv) Computer Workshop
v) RT (Radio Telephony) - Communication

Note : All the shops to be well equipped to carry out practical of the students. The Cost of the above infrastructure is Rs. 80,55,000/- (approx. as on date)

c) After starting the Course, the Infrastructure required in the Organization at the start of Third semester i.e. Second year will be as follows:-

i) Hanger and Tarmac : For parking aircrafts, their run-up and taxying for functional checks of the various systems.
ii) Aircrafts : 1) Light aircraft (weight below 5700 kg) & Piston engine
2) Heavy aircraft (weight above 5700 kg) & Jet engine
iii) Workshops : 1) Engine Workshop
2) Airframe Workshop

The Cost of the above is Rs. 2,93,00,000/- (approx. as on date)
Total cost for all three years a) + b) + c) = Rs. 3,98,55,000/-

Faculty Qualifications and requirements:

Chief Instructor : a) One each, having BAMEL (Basic Aircraft Maintenance Engineering Licence) and at least five years of Aviation Experience of which at least two years in the field of Instruction **OR**

b) Engineering Graduate with at least two years of Practical experience in Aviation Industry of which at least one year in the field of Instruction.

Instructors :

Year	New Appointments	Total Appointments
1st year	03	03
2nd year	03	06
3rd year	03	09

Non Teaching

Office staff : 02 Jr. Clerk
Peon : 03

External Theory examination 60 Marks

i) Duration – These examinations shall be of 2 Hours duration for each paper.

ii) Theory Question Paper Pattern:-

- There shall be four questions each of 15 marks. On each unit there will be one question and the fourth one will be based on entire syllabus.
- All questions shall be compulsory with internal choice within the questions.

(Each question will be of 20 to 23 marks with options.)

- Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

Scheme of Examination

SEMESTER I (Mechanical Stream)

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Task	Internal		Written	Task
USARM 101	Civil Aviation Legislation to cover CAR Series A to J and Human factor.	60	40	--	--	100	2 Hrs.	--
USARM 102	General Engineering to cover Physics & Maths.	60	40	30	20	150	2 Hrs.	2 Hrs.
USARM 103	Maintenance Practices & Hardware	60	40	--	--	100	2 Hrs.	
USARM 104	Electrical & Electronic Fundamentals.	60	40	30	20	150	2 Hrs.	2 Hrs.
USARM 105	Engineering Drawing	--	--	60	40	100	--	2 Hrs.
	Communication Skill	60	40	--	--	100	2 Hrs.	--
	Total					700		

SEMESTER II (Mechanical Stream)

Course Code	Title of the Course	Theory		Practical		Total	Duration	
		Written	Internal	Task	Internal		Written	Task
USARM 201	Civil Aviation Regulations Series K-X, Advisory Circulars, CAR - 145	60	40	--	--	100	2 Hrs.	--
USARM 202	Aircraft Electricity & Electronics Paper I	60	40	--	--	100	2 Hrs.	--
USARM 203	Digital Techniques & Instruments–Paper I	60	40	30	20	150	2 Hrs.	2 Hrs.
USARM 204	Workshop Technology, Corrosion, NDT.	60	40	--	--	100	2 Hrs.	--
USARM 205	A/c Structure & Systems Paper I: Theory of Flight, Ice & Rain, Hydraulics, Pneumatics.	60	40	30	20	150	2 Hrs.	2 Hrs.
USARM 206	Environmental Studies	60	40	--	--	100	2 Hrs.	--
	Total					700		