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Item No. 4.20

UNIVERSITY OF MUMBAI



Syllabus for
F.Y.B.Sc. (SEM-I & SEM-II)
Program: B.Sc.
Course: Aviation

(Credit Based Semester and Grading System with
effect from the academic year 2014–2015)

F.Y.B.Sc. Aviation Syllabus
For Credit Based and Grading System
To be implemented from the Academic year 2014-2015
Semester I

Course Code	Title	Credits
USAV101	Air Navigation I	5 Credits (60 lectures)
Unit I		Lectures
1) <u>Direction, Latitude & Longitude</u> Shape of the earth, geodesy and geoid models, poles, basic directions on the earth, sexagesimal system/true direction.		2
2) <u>Circles on the Earth</u> Great circle, the Equator, the Meridians, small circle, parallels of latitude, graticule, latitude, geocentric & geodetic latitude, longitude, great circle vortices, the Rhumb Line, Great circle & Rhumb Line track & distances, kilometer statute mile & nautical mile variations in the length of a nautical mile		6
3) <u>Earth Magnetism</u> True and magnetic direction, variation, change of variation, isogonals, magnetic dip angle, vertical and horizontal component, deviation, application of variation and deviation, agonic line, isoclinals, aclinic lines		4
4) <u>Triangle of velocities</u> 4Definitions of Heading, track, wind velocity, true air speed, ground speed, drift, the air vector, the wind vector, the ground vector		4
		<hr/> 16
Unit II		Lectures
1) <u>Navigation Computer</u> :- Slide rule face, distance, speed, time and conversions, TAS and altitude conversions, calculation of track and ground speed, wind finding and calculation of heading, head wind and cross wind component, calculation of fuel consumption		10
2) <u>Exercises in preparation of flight plans</u>		8
3) <u>The 1 in 60 rule</u> :- Use in navigation and other application		4
4) <u>Convergency and conversion angle, departure, scale</u>		6
		<hr/> 28

UNIT III	Lectures
9) <u>General chart properties</u> Prospective and prospective charts, the “Reduced Earth”, Types of projection, properties of an ideal chart, orthomorphism/ conformality	4
10) <u>Mercator Charts</u> Cylindrical projections, direct Mercator projections, properties of Mercator charts, Mercatorscale questions	6
11) <u>Lamberts Conical Orthomorphic Projection</u> Modification of simple conic projection, orthomorphism, scale errors, chart convergence, properties, advantages and disadvantages.	6
	16

REFERENCE BOOKS

TITLE	PUBLISHER
1. Air Pilot’s Manual Vol 3 & 5	Peter D Godwin
2. Flight Performance & Planning	Nordian AS
3. General Navigation: ATPL JAR	Nordian AS
4. GSP : Plotting & Flight Planning	Underdown
5. GSP : Radio Aids	Underdown
6. GSP : Flight Instr. & Auto Flt.	Underdown
7. GSP : Navigation	Underdown
8. Radio Navigation ATPL JAR	Nordian AS
9. Oxford Aviation Gen Navigation	Jeppesen

Course Code	Title	Credits
USAV102	Air Regulation I	3 Credits (45 lectures)
Unit I		Lectures
1) Aviation Phonetics		1
2) Aviation Terminology		2
3) Aviation Phraseology		2
4) Introduction of Aviation bodies (ICAO, DGCA, FAA, JAR, CASA, WMO)		4
5) ICAO Annexure & DGCA Documents		3
6) Introduction of		4
I. Chicago Convention 1944		
II. Warsaw Convention 1929		
III. Rome Convection 1952		
IV. Tokyo Convention 1963		
NOTE – NO CHANGE FROM THE OLD SYLLABUS, BUT TOPICS ARE REARRANGED		<hr/> 16
<u>UNIT II</u>		Lectures
1. Aeronautical Information Services		
I. AIP		3
II. NOTAM		3
III. AIC		2
IV. AIRAC		2
V. PIB		1
VI. CAR		1
NOTE – NO CHANGE FROM THE OLD SYLLABUS, BUT TOPICS ARE REARRANGED		<hr/> 12
<u>UNIT III</u>		Lectures
1. Indian A/c Rule 1934 (Rules 1-19)		5
2. Indian A/c Rules 1937		3
Part I Extent & Definitions		
3. Schedule – I Prohibited Areas		2
4. Schedule – II Licenses		1
I. Students Pilot License		1
II. Private Pilot License		1
III. Commercial Pilot License		1
IV. Airline Transport Pilots License		1
V. Instrument Rating		1
VI. FRTOL (R)		1
VII. RTR (A)		1
NOTE – NO CHANGE FROM THE OLD SYLLABUS, BUT TOPICS ARE REARRANGED		<hr/> 17

REFERENCE BOOKS

TITLE	PUBLISHER
1. Aviation Act 1934	Ministry of Civil Aviation
2. Indian Aircraft Rules	Ministry of Civil Aviation
3. Aeronautical Information Publication	Ministry of Civil Aviation
4. Aircraft Manual Vol I & II	DGCA, India

Course Code	Title	Credits
USAV103	Meteorology I	3 Credits (45 lectures)
<u>Unit I – Atmosphere</u>		Lectures
a) Reasons for studying MET		1
b) The Atmosphere : Composition, and the Structure		2
c) Tropopause heights		2
d) Indian Standard Atmosphere		2
e) Heating of the atmosphere & Latent heat of water		2
f) Green house gases		2
g) Surface heating and cooling		2
h) The earth's heat budget & albedo		2
Total		15
<u>Unit II – Temperature and Pressure</u>		Lectures
a) Temperature, effect of latitude, diurnal variation of temperature		2
b) Short waves & Long waves of radiation and the related laws		2
c) Temperature changes with height, ISA conditions		2
d) Inversions in the upper air		2
e) Pressure, variation with height		2
f) Q code of pressure		1
g) Altimeter settings		2
h) Pressure altitude, true altitude, height and flight level		2
		15

<u>Unit III – Air density & stability of the atmosphere</u>	
a) Density of air, its units and relationship with pressure and temperature	2
b) Water within the atmosphere, Water vapors content, Relative humidity	2
c) Dew point and its calculation	1
d) Stability of the atmosphere	2
e) Lapse rate, ELR, DALR, SALER & DPLR	2
f) Determination of the stability of the atmosphere and its calculations	2
g) Freezing level in clouds and outside the clouds	2
h) Clouds tops and height of base of clouds calculations	2
	15

Course Code	Title	Credits
USAV104	Aircraft & Engines I	5 Credits (60 lectures)
Unit I		Lectures
<ol style="list-style-type: none"> 1. Major components of aircraft, construction material and corrosions. 2. Basic revision of physics, weight, mass, various laws force, work, power energy 3. Principle of flights, aerodynamics, AC & CP – Pitching moments 4. Forces acting on Aircraft during ST & LVL – climb descent turn 5. Types of drag, lift drag ratio & drag speed rotation 6. Flight controls, primary controls primary & second load factors stability controllability & maneuraeability 		<p>4</p> <p>4</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <hr/> <p>20</p>
Unit II		Lectures
<ol style="list-style-type: none"> 1. Atmosphere – Pressure Altitude, Density Altitude, OAT, SAT, TAT & Conversions 2. Light A/C Single engine speeds & T/O , CLB Range max endurance & landing performance, various segments, ground effect & stabilities, controllability & manueraeability 3. RTOW & various calculation, Speeds V1, V2, Vr, Vlof, Vfs Max Structural- field length, ZFW, MLW, VMBE- Various other restrictions 		<p>5</p> <p>7</p> <p>8</p> <hr/> <p>20</p>
Unit III		Lectures
<ol style="list-style-type: none"> 1. Electrical power, DC, AC, Various Laws, Power distribution to various buses, Ammeter/ Load meters 2. Fire protection & Detection system 3. Engine fire on ground & In flight & procedures for Basic Engine Aircraft 4. Various types of DC/ AC Switches, Batteries – DC Electric & Magnetism Molecular Theory 5. Generator & Alternator – Rectifier, Inverters – SHUFTED FROM UNIT II IN OLD SYLLABUS. 		<p>5</p> <p>5</p> <p>5</p> <p>4</p> <p>1</p> <hr/> <p>20</p>

REFERENCE BOOKS

TITLE

Flight Without Formula
From the Ground Up
Manual of Flying (AP 129)
Pilot's Handbook for Aeronautical
Knowledge
Flight without formula
Mechanics Of Flight
JAR – ATPL Gen Knowledge
Manual of flying AP 129

PUBLISHER

Kermode
Sandy A. F. Macdonald
Air Ministry UK
FAA

AC Kermode
AC Kermode
Jeppesen
Air Ministry U.K

Semester II

Course Code	Title	Credits
USAV201	Air Navigation II	5 Credits (60 lectures)
<u>UNIT 1</u>		Lectures
1) <u>Basic Radio Theory</u> Wave Motion, electro-magnetic waves, properties of radio waves, refraction, diffraction and reflection, relationship between frequency, wavelength and velocity, Phase difference, surface waves, sky waves, space waves, critical angle dead space, the ionosphere, skip distance, duct propagation, aerials, polar diagrams, aerial feeders and directivity, modulation, keying, amplitude modulation (AM), frequency modulation (FM), pulse modulation (PM), classification of emissions.		10
2) <u>Communications</u> Long range communication, HF communications, short-range communication, VHF communication, Selective calling system (SELCAL), internal communications (INTERCOM), Satellite communications (SATCOM), search and rescue satellites, ACARS		4
3) <u>ADF :-</u> Loop Theory, Resolution of Ambiguity, ADF control unit, BFO or CW / RT, uses of ADF, Homing and Tracking away from the station, Factors affecting range and accuracy of ADF		6
		<hr style="width: 10%; margin: auto;"/> 20
<u>UNIT II</u>		Lectures
4) <u>VOR</u> Principle of Operation, Derivation of Phase difference, airborne equipment, OBS, to/from and left/right deviation indicator, VOR frequencies, use of VOR, cone of confusion, factors affecting VOR range and accuracy, advantages/disadvantages as navigational aid, TVOR, DVOR, exercises on use of VOR indications and RBI		10
5) <u>RMI</u> QDM's and relative bearing indications, discrepancies in VOR and ADF indications, advantages of RMI, VOR-NDB-RMI exercises.		2
6) <u>Instrument Landing System</u> 8 Introduction, ILS components/frequencies, DME paired with ILS channels, ILS identification, Marker Beacons, Ground Monitoring, Coverage, Principle of Operation Localiser, Back-course ILS, Glideslope, False Glideslopes, ILS categories, Operational Performance Categories, Errors and Accuracy, ILS calculations, Introduction to Microwave Landing System		8
		<hr style="width: 10%; margin: auto;"/> 20

<u>UNIT III</u>	Lectures
<p>7) <u>Air Speed Indicator :-</u> Static Pressure, pitot pressure, dynamic pressure, IAS, CAS, EAS, TAS, Square law compensation, limiting speeds, ASI errors.</p>	2
<p>8) <u>Altimeters</u> Principle of construction of simple altimeter, Rate of pressure change with altitude, Sensitive, Altimeter constructions, subscale setting, servo assisted altimeter, altimeter errors</p>	2
<p>9) <u>Vertical speed indicator</u> Principle of operation, Instantaneous vertical speed indicator, errors. shifted from unit II in old sem</p>	2
<p>10) <u>Air Temperature Measurement</u> Effect of Compressibility, static air temperature (SAT), Total air temperature (TAT), Ram Rise, Errors</p>	2
<p>11) <u>Machmeter</u> High speed flight, operating limits, speed of sound, principle of construction, machmeter errors, blockages, relationship between mach number, true air speed and RAS in climb and descent in standard atmosphere, isothermal layer and inversion. Mach/Airspeed indicator, numerical problems of machmeter</p>	5
<p>12) <u>Gyroscopes</u> Fundamental properties, factors affecting rigidity, precession rate, wander, real wander, apparent wander, tied gyros, rate gyros, application of the properties of a gyro, suction and electric gyros, Tuned rotor gyro, laser gyro, fibre-optic gyro, advantages and disadvantages of electric and suction gyros</p>	7
	20

REFERENCE BOOKS

TITLE	PUBLISHER
1. Air Pilot's Manual Vol 3 & 5	Peter D Godwin
2. Flight Performance & Planning	Nordian AS
3. General Navigation: ATPL JAR	Nordian AS
4. GSP : Plotting & Flight Planning	Underdown
5. GSP : Radio Aids	Underdown
6. GSP : Flight Instr. & Auto Flt.	Underdown
7. GSP : Navigation	Underdown
8. Radio Navigation ATPL JAR	Nordian AS

Course Code	Title	Credits
USAV202	Air Regulation II	3 Credits (45 lectures)
Unit I		Lectures
<u>Air Traffic Services</u>		
1. Airspace Organization		5
2. Flight Information Service & alerting service		1
3. Aerodrome Control Service		3
4. Vicinity Separation in the vicinity of aerodromes		3
5. Separation Methods & Minima		3
		<hr/> 15
Unit II		Lectures
<u>Schedule – IV (Rules of Air)</u>		
1. Definitions		2
2. General Rules		2
3. Rules of Air (IFR, VFR & Special VFR)		3
4. Avoidance of collision		3
5. Flight Plan		3
6. ATC Control service		2
7. Unlawful Interference		1
8. Interception		1
9. VMC Visibility & distance from cloud minima		1
10. Signals (Distress, Urgency, Light & Visual)		4
11. Semi – Circular Rules & RVSM		2
12. Navigation lights displayed on A/C.		1
NOTE –SUBDIVIDED INTO MORE PARTS FOR BETTER EXPLANATION COMPARED TO OLD SYLLABUS.		
		<hr/> 25
Unit III		Lectures
<u>Search & Rescue Organisation and procedures in India as per Indian aircraft rules.</u>		05

REFERENCE BOOKS

TITLE	PUBLISHER
1. Aviation Act 1934	Ministry of Civil Aviation
2. Indian Aircraft Rules	Ministry of Civil Aviation
3. Aeronautical Information Publication	Ministry of Civil Aviation
4. Aircraft Manual Vol I & II	DGCA

Course Code	Title	Credits
USAV203	Meteorology II	3 Credits (45 lectures)
Unit 1 - Clouds & Precipitation		Lectures
a) Structure of the clouds and its basic definition		1
b) Types of clouds		1
c) General classification and the heights over tropical, temperate and polar latitudes		2
d) Special names of some famous clouds		1
e) Cloud formations and their characteristics and dispersal		1
f) Isothermal and adiabatic cooling of the atmosphere		1
g) Clouds and classifications as per their formations		2
h) Clouds in stable and unstable air		1
i) Fair weather clouds		1
j) Convective clouds and their relation with the ELR		2
k) Turbulence clouds		1
l) Precipitation and its types		1
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		15
Unit 2 – Thunderstorms		Lectures
a) Definition		1
b) Development		3
c) Lightening		1
d) Hazards		3
e) Tornadoes		2
f) Water spouts		2
g) Microburst's		3
		<hr/>
		15
Unit 3 – Visibility, Fog & measurement of met parameters		Lectures
a) General visibility		1
b) Slant visibility		1
c) Reasons of poor visibility		2
d) RVR		1
e) Dust devils		1
f) Fog, haze & mist'		2
g) Steaming fog, smoke haze		2
h) Diurnal, seasonal & location variations of fog		3
i) Formation of fog and relation to winds		2
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		15

REFERENCE BOOKS

TITLE	PUBLISHER
Ground Studies for pilots	R. B. Underdown & John Standan
Meteorology for Pilots	Mike Wickson
Meteorology for Pilots	Mcgraw Hill
Meteorology for Aviators	Sutcliffe
Elementary Note on Indian Climatology	India Met Dept..
Ground Study for Pilots	Taylor & Parmar
Indian Climatology	IMD Publications
Climatology	Satvindra Singh
Met Question Bank	Joshi

Course Code	Title	Credits
USAV204	Aircraft & Engines II	5 Credits (60 lectures)
Unit I		Lectures
<p>1. Pitot Static Systems:- Pressure Instruments, Altimeter, Airspeed Indicators, VSI, IVSI with errors Effect of Non- standard Atmosphere Pressure & Temperature, Various Altimeters Setting Procedure</p>		8
<p>2. Airspeed Indicator Markings, IAS, CAS/RAS, EAS, TAS and other airspeed limitations- V_{lo}, V_{le}, V_x, V_y, V_{mca}, V_{mcg}, V_{yse}, V_{so}, V_{s1}, V_{ne}, V_{app}, V_{ref}, Approach & landing Climb</p>		6
<p>3. Principle of magnetic compass, variation compass deviation, DRC, VCC, Acceleration/ Dec & Turning errors</p>		6
<p>BASIC PITOT STATIC AND SPEEDS ADDED FOR BETTER BASE OF STUDENTS & UNDERSTANDING.</p>		<hr/> 20
Unit II		Lectures
<p>1. Gyroscopic flight instrument properties rigidity, precession, source of power (Turn 7 slip indicator, Turn Coordinator, Inclinometer, All Indicator Heading Indicator) Gyro Instruments.</p>		7
<p>2. Mach no. SST A/C Supersonic or Subsonic flow various Mach speeds Shock wave, Mach Tuck & Tuck under Mach Trim System</p>		7
<p>3. Sweep Back & High speed, Mac Buffet & Control Reversers & Powered flight Controls – SHIFTED FROM UNIT I OF SEM III</p>		6
		<hr/> 20
Unit III		Lectures
<p>1. AUX Power Unit, Ground Electrical & Air Conditioning Units & Supports APU Operation, APU Operation, APU Air Supply, Lubrication Cooling, Antiskid System, Fire Detection & Protection for APU, APU precautions, Auto shut down.</p>		10
<p>2. APU Air operation - speed & High Altitude Restrictions APU doors – squat switch operation</p>		5
<p>3. Heating system windows, Pitot – Nacelle, drains, Anti-ice, De-ice</p>		5
<p>SHIFTED FROM UNIT II OF SEM II</p>		<hr/> 20

REFERENCE BOOKS

TITLE	PUBLISHER
Flight Without Formula	Kermode
Aero Engines for students	Allen and Unwin
Gas Turbine and Jet Propulsion	Smith
Handbook of Aeronautics	Royal Aeronautical Society
Civil Aviation Requirements	DGCA India
Principles of Flight	Bert A Shield
Performance of Civil Aircraft	Barker
System Commercial Pilot study manual	Mike Burton
Handling of Big Jet	D.P Davis
JAA – ATPL A/C Gen Knowledge	Oxford

