

UNIVERSITY OF MUMBAI



**Syllabus for T.Y.B.Sc.
Program: B.Sc. (SEM-V & SEM-VI)
Course: Aviation**

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

SEMESTER V

USA V501

USA V501 : Air Navigation V Credits: 5 Lectures/Week: 4 Lectures/Semester: 60

UNIT I

No of Lectures

- 1) **Ground Proximity Warning System (GPWS)** 6
Introduction, Definitions, EGPWS Operating Modes, Enhanced Ground Proximity Warning Systems (EGPWS)
- 2) **Flight Management System** **SHIFTED FROM SEM V (UNIT 1)** 6
Principle of Operation, Control and Display Unit (CDU), Database, Operational Procedures Climb Vertical Navigation (VNAV), Cruise Lateral Navigation (LNAV), Descent, Accuracy
- 3) **Electronic Flight Information System (EFIS)** 8
EFIS Introduction, Units, Symbol Generators (SGs), Display Units, Color display system, Remote Light sensor, control panel, Decision Height (DH), EADI display presentation, EHSI section of the control panel, system symbols, EHSI display presentation – VOR, ILS, MAP & PLAN, Navigation Displays

Total 20

UNIT II

- 4) **Satellite Navigation System** **SHIFTED FROM SEM VI (UNIT 3)** 10
Principle of Operation, Space Segment, Control Segment, User Segment, GLONASS & GPS, Selective Availability, Errors of GPS, GPS Integrity & Augmentation, RAIM, Differential GPS, Use advantages & Disadvantages of Satellite Navigation System
- 5) **Introduction to Jeppesen Charts** 6
Definitions, Enroute Chart Legend, High Altitude Charts, Area Charts, SID/DP and Star Legend, Approach Chart Legend, Airport Chart Format, Arrival Charts (STARs)
- 6) **Area Navigation System (RNAV)** 4
Introduction, Benefits of RNAV, Types & levels of RNAV, Components and Operation of 2D RNAV system, Principal of Operation and limitations of simple RNAV systems, Level 4 RNAV system, control display unit (CDU)

Total : 20

UNIT III

No of Lectures

- | | |
|--|----|
| 7) <u>Atc Flight Plan</u> | 4 |
| Individual (CA48) and repetitive flight plan, procedures to fill up the flight plan VFR & IFR flight plans | |
| 8) <u>Mass and Balance</u> | 12 |
| Limitations, Effects of overloading, Effects of out of limit CG position, Movement of CG in flight, Definitions, Centre of Gravity, Centre of Gravity limits, Centre of Gravity Datum, Arm, Moment, Loading Index, Dry Operating Index, Basic Empty Mass, Dry Operating Mass, Operating Mass, Traffic Load, Useful Load, Zero fuel mass, maximum zero fuel mass, take-off mass, maximum structural take off mass, maximum structural landing mass, maximum range mass (Max structural taxi mass), calculation of fuel mass, calculation of centre of gravity | |
| 9) <u>Fuel Planning</u> | 4 |
| Calculation of minimum quantity of fuel for a flight based in taxi fuel, trip fuel, contingency fuel, alternative fuel and holding fuel & decision point procedure | |

Total 20

REFERENCE BOOKS

TITLE

1. Air Pilot's Manual Vol 3 & 5
2. Flight Performance & Planning
3. General Navigation: ATPL JAR
4. GSP : Plotting & Flight Planning
5. GSP : Radio Aids
6. GSP : Flight Instr. & Auto Flt.
7. Range & Endurance
8. Radio Navigation ATPL JAR
9. JAA ATPL Performance
10. JAA ATPL Mass & Balance
11. Mass & Balance
12. Performance
13. Jeppesen Chart Training

PUBLISHER

Peter D Godwin
Nordian AS
Nordian AS
Underdown
Underdown
Underdown
Hitchens
Nordian AS
Jeppesen
Jeppesen
Cranfield
Cranfield
Jeppesen

USA V502

USA V502: Air Regulation V Credits: 3 Lectures/Week: 3 Lectures/Semester: 45

UNIT I

No of Lectures

1. Act 1954 (Part I, II, III, IV & V)	5
2. Wake Turbulence Categories	5
3. All types of licenses other than Pilot's License	5
Total	<u>15</u>

UNIT II

No of Lectures

1. Carriage by Air Act 1972 Liabilities of the Carrier Rules (17-22)	6
2. Regulation for use of AAI Aerodromes & Airfields	3
3. Area navigation	1
4. Required Navigation Performance on ATS routes	2
5. FDTL (Flight Duty Time Limit)	3
Total	<u>15</u>

UNIT III

No of Lectures

1. Schedule – V Penalties	5
2. Bird Strike	1
3. Entry Transit & Departure	3
4. Minimum Oil & Fuel to be carried by public transport A/C	1
5. Procedure in regard to A/C equipped with ACAS	1
6. Minimum safe altitude warning procedures	2
7. Priority landing	1
8. Oxygen Supply	1
Total	<u>15</u>

NOTE – THE ABOVE TOPICS ARE COVERED UNDER VARIOUS AIRCRAFTS RULES UNIT 1, REARRANGE AND ADDED TOPICS TO COVER THE PRESENT NEED OF AVIATION REQUIREMENTS.

REFERENCE BOOKS

TITLE	PUBLISHER
1. Radio Telephony	Peter D Godwin
2. Human Factors and Pilot performance	Trever Throme
3. JAA- ATPL Communications	Jeppesen
4 Indian Aircraft Manual Vol I & II	Ministry of Civil Aviation
5. Aeronautical Information	Ministry of Civil Aviation

USAV503

USAV503: Meteorology V Credits: 3

Lectures/Week: 3 Lectures/Semester: 45

UNIT I

No of Lectures

Flight Hazards

- | | |
|---|---|
| a) Icing | 3 |
| • Weather conditions for Ice Accretion, | |
| • Types of Ice Accretion | |
| • Avoidance | |
| b) Turbulence | 3 |
| • Effects on Flight, Avoidance | |
| • CAT – Effects on Flight | |
| c) Wind Shear | 4 |
| • Definition of Wind Shear | |
| • Weather conditions for Wind Shear | |
| • Effects on Flight | |
| d) Mountain waves & Standing waves | 5 |

Total 15

UNIT II

No of Lectures

- | | |
|--|---|
| a) Low pressure systems and Fronts- cold Fronts, warm fronts cloud sequences in them, warm and cold occluded fronts, depressions, and their effects on aviation. | 5 |
| b) Non frontal depressions – orographic, thermal, cyclones and tornadoes | 5 |
| c) Anti cyclones and cols and associated weather in summer and winter, upper level, convergence and subsidence | 5 |

Total 15

UNIT III**No of Lectures:45**

a) Meteorological organization in India and in world and station model	3
b) Measuring instruments used for measuring weather parameter	2
c) METARS, TAFS, ROFORS, and Aireps	3
d) Sigmet	2
e) Weather charts and prognostic charts, times of issue and validity	3
f) Reading the charts and interpreting data plotted	2

Total	<u>15</u>
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REFERENCE BOOKS**TITLE**

- 1) Ground Studies for pilots
- 2) Meteorology for Pilots
- 3) Elementary Note on Indian Climatology
- 4) Handbook of Aviation Meteorology
- 5) Meteorology for Airmen Dept.
- 6) Ground Study for Pilots
- 7) Climatology
- 8) Oxford Aviation Academy

PUBLISHER

R. B. Underdown & John Standan
Mcgraw Hill
India Met Dept.
HMSO
Parts I & II Met.
Taylor & Parmar
Prof Savindra Singh
E- BOOK Oxford University

USAV504

USAV504: Aircraft & Engines V Credits: 5 Lectures/Week: 4
Lectures/Semester:60

UNIT I

SHIFTED FROM SEM 2

No of Lectures

1. Jet Engine Principle & working cycle, Major components, Compressor, Burner, Turbines, centrifugal & Axial Compressor. Advantages and Disadvantages of these compressors 5
2. Jet engine fuel, oil internal cooling & sealing, gear box , accessory gear box 5
3. Starting- Wet start, Hot start, Hung Start, Engine Surge & compressor stall engine flow oil & restart in flight 5
4. Ignition and various methods of starting, fire detection & protection system of Jet engine Thrust Reverser system, thrust augmentation system after burner & noise suppression system 5

Total 20

UNIT II

SHIFTED FROM SEM 1 (UNIT 1)

No of Lectures

1. Piston engine cylinder, magnetos, ignition, low tension, T/P/M & Power setting procedure 6
2. Left hand turning tendencies of conventional type of A/C 4
3. Propeller blade and various associated terms with it – Prop Thrust power and drag Torque 5
4. **Artificial Feel & principle powered controls & feel - Addition** 5

Total 20

UNIT III**No of Lectures**

- | | |
|---|---|
| 1. FADAC, FADAC Engine, CVR, DFDR, Engine failure mode in glass cockpit | 7 |
| 2. Emergency force landing landing, ditching & evacuations and safety
equipmentt | 7 |
| 3. Spiral dive, stall, Spin, dutch roll entry & recovery procedures, skid, slip & cross
control procedure. | 6 |

Total **20**

REFERENCE BOOKS**TITLE****PUBLISHER**

- | | |
|-----------------------------------|------------------|
| 1) Jet engine | Rolls Royce |
| 2) Jet Engine | Pratt & Whitney |
| 3) Piston Engine & Turbine Engine | Mike Burton |
| 4) Aircraft General Knowledge | Oxford/ Jeppesen |

SEMESTER VI

USAV601

USAV601: Air Navigation VI

Credits: 5

Lectures/Week: 4

Lectures/Semester: 60

UNIT 1

No. of Lectures

- 1) **Calculation of Payload** **SHIFTED FROM SEM 5 UNIT (3)** 4
- 2) **Holding Patterns** 8
Identification of Sectors, Procedure for Joining the Holding Pattern, Holding Procedure with correction for leg timing and Drift due to wind
- 3) **Low Visibility Operations** 8
Requirements to be fulfilled for low visibility operations, ILS, CAT I, CAT II and CAT III operations, conditions for approval of low visibility take-off operations

Total : 20

UNIT II

- 4) **Minimum Navigation performance specification airspace (MNPSA)** 2
Introduction, Considerations, Transoceanic navigation problems
- 5) **Reduced Vertical Separation Minimum (RVSM)** 6
Aeroplane requirements, navigation system requirements, and serviceability, NAT tracks, OTS track designation, OTS changeover, Track message (TM), Track message identifier, Track routings, allocation of Flight levels
- 6) **Search and Rescue** **ADDED DUE TO MODERN ADVANCEMENT IN AVIATION** 12
Definitions – Alert Phase, Distress Phase, Emergency Phase, Operator, Pilot-in-command (PIC), Rescue co-ordination centre (RCC), State of Registry, Uncertainty phase, Establishment and provision of SAR Service, co-operation between states, operating procedures, communication with survivors, signals with surface aircraft, SAR signals, Ground air visual signal code for use by survivors, air to ground signals, types of searches

Total : 20

UNIT III

- 7) **Inertial Navigation System** 8
Introduction, Basic principles, Accelerometer and integrators, Effects of gravity on Accelerometer, Integrating Gyroscope, Platform, Earth orientation, Apparent wander, Alignment of the system, Schuler period, Errors of INS, INS control and display panels, LED display, Manual and automatic system checks
- 8) **Inertial Reference System** 4
Introduction, Primary source of information, laser gyro, principles of laser gyros and IRS, construction and operation, limitations and accuracy, platform/strap down principles, platform alignment, advantages
- 9) **Aircraft Performance** **SHIFTED FROM SEM V (UNIT 2)** 8
Definitions – Alternate airport, accelerate-stop distance available (ASDA), take-off run available (TORA), Take off Distance available (TODA), balanced field, calibrated airspeed, ceiling, climb gradient, clearway, critical engine, density altitude, equivalent airspeed, stopway, runway slope, unaccelerated flight, available distance for take-off, Dry, Wet and Contaminated runway, Obstacle clearance altitude height (OCA/H), Decision altitude/Height (DA/H), Minimum Descent Altitude/Height (MDA/H), Runway Visual Range (RVR)

Total : 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. Range & Endurance	Hitchens
8. Radio Navigation ATPL JAR	Nordian AS
9. DGCA Ops Circular 06/1999	Aerodrome Operating Minima
10. DGCA Ops Circular 07/2010 ACAS Eqpt	Operational Procedures and Trg Reqts for
11. CAR Air Operations Series B Pt I	ILS CAT II/IIIA/B Operations
12. CAR Air Operations Series O Pt 11 RVSM	Requirements for implementation of
13. CAR Air Operations Series O Pt XII PBN,	Airworthiness, Operational and Trg

Unit I

1. Aviation and Medicine	1
2. Effect of smoking	1
3. Effect of Alcohol and drugs	1
4. Rapid decompression	1
5. Middle ear discomfort and Pain	1
6. Hypoxia and types	1
7. Hyperventilation	3
8. Spatial disorientation	1
9. Effect of scuba diving	1
10. Effect of carbon mono oxide poisoning	1
11. Blood donation	1
12. Jet lag	1
13. Circadian/ Bio – rhythms	1

NO CHANGE BUT REARRANGED THE TOPICS

15

Unit II

Crew resource management and Flight Safety	2
1. Need for CRM	1
2. Human factors and flight safety	2
3. Situation awareness	2
4. Team performance	2
5. Decision making	2
6. Stress	2
7. Error Performance and safety	2

15

Unit III

Security	5
1. Introduction	
2. Objectives	
3. Organizations	
4. Preventive security measures	
5. Management of response to Act of Unlawful Interference	
Aircraft Accident and Incident Investigation	5
1. Introduction	
2. Objective of Investigation	
3. Investigation	
4. Serious Incidents	
5. EU Considerations	
Human Factors and Pilot Performance	3
Safety, First Aid and Survival	2

NO CHANGE BUT ONLY REARRANGED THE TOPIC WITH SUB DIVISIONS

Total 15

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	India
5. Human factors and Pilot performance	Trever Throme
6. ATPL Training Manual Air Law	Oxford
7. JAA – ATPL Communication	Jeppesen

USAV603: Meteorology VI Credits: 3 Lectures/Week: 3 Lectures/Semester: 45

UNIT I

No of Lectures

METEOROLOGICAL INFORMATION

a) Observations	2
b) On the Ground – pressure, temperature, humidity	1
c) Visibility, RVR, Transmissometers	2
d) Clouds, types height of bases Ceilometers	1
e) Upper air observations	2
f) Weather radar satellite observations, interpretations & Doppler radar	2
g) Aircraft observations	1
h) Supplying the weather information's to pilots and air traffic controllers	2
i) Volmet broadcasts	1
j) Weather warning for adverse weather	1
Total	<u>15</u>

UNIT II

No of Lectures

a) World climatology	4
b) January and July weather conditions in Northern hemisphere and southern hemisphere	3
c) Surface weather charts	3
d) Upper air charts	2
e) Sysmbols and signs used on the charts	3
Total	<u>15</u>

UNIT III**No of Lectures**

a) Information on flight planning	3
b) Aeronautical codes	3
c) Meteorological broadcasts	3
d) Meteorological briefings	3
e) Symbols and signs used on the charts	3

Total 15

REFERENCE BOOKS**TITLE**

- 1) Ground Studies for pilots
- 2) Meteorology for Pilots
- 3) Elementary Note on Indian Climatology
- 4) Handbook of Aviation Meteorology
- 5) Meteorology for Airmen Dept.
- 6) Ground Study for Pilots
- 7) Climatology
- 8) Oxford Aviation Academy

PUBLISHER

R. B. Underdown & John Standan
Mcgraw Hill
India Met Dept.
HMSO
Parts I & II Met.
Taylor & Parmar
Prof Savindra Singh
E-Book Oxford University

USA V604

USA V604: Aircraft & Engines VI Credits: 5 Lectures/Week: 3
Lectures/Semester: 60

UNIT I REARRANGED FROM SEM I UNIT 1 AND SEM II UNIT 1

No of Lectures

• Comparison of Jet Engine & Piston Engine performance, Acceleration time, Slipstream & absence of propeller drag, response of throttle	8
• Noise abatement technique	4
• Various engine locations, advantages & disadvantages of engine operation, engine damage by FOB, Bird, Water, Ice and jet engine intake stall	8
Total	<u>20</u>

UNIT II

No of Lectures

• Flying faster & low sweptback, yaw & roll damper, trimmer stall & super stall	8
• Flying higher & controllability, mach trim & emergency descent	4
• Aqua planning	3
• Reduce power takeoff; flex power, d-rated power, T/O, RTO & landing performance	5
Total	<u>20</u>

UNIT III

No of Lectures

• Contaminated runway Take off & landing	4
• Flight through severe weather & turbulence	4
• ENROUTE FLYING THROUGH VOLCANIC ASHES	1
• Jet upset recovery from mild, moderate & gross upset	4
• Partial gear operation, landing, gear down ferry flight & abnormal operation	4
• Emergency brakes & steering system	3
Total	<u>20</u>

REFERENCE BOOKS

TITLE

Flight Without Formula
Aero Engines for students
Gas Turbine and Jet Propulsion
Handbook of Aeronautics
Civil Aviation Requirements
Principles of Flight
Performance of Civil Aircraft
From the Ground Up
Manual of Flying (AP 129)
Handling Big Jets

PUBLISHER

Kermode
Allen and Unwin
Smith
Royal Aeronautical Society
DGCA India
Bert A Shield
Barker
Sandy A. F. Macdonald
Air Ministry UK
D P Davis

PROJECTS (4 lectures per week)

1. CRM & Human Factors
2. Aviation Medicine & First Aid
3. Flight Safety
4. Air Traffic Control & Management
5. Aviation Safety & Security Management
6. Fuel Economy
7. Aircrew Survival over Sea and Land
8. Future Air Navigation Systems
9. Airline Route Planning
10. Airline Operations and Scheduling

Out of the Projects listed above, Four Projects will be allotted by the college during Semester VI. Students will only be required to study and submit these four projects. The projects are to be completed under the guidance of the teacher from the institute/ college/ any other related industry.

REFERENCE BOOKS

TITLE	PUBLISHER
1) Crew Resource Management	Brian Mcallister
2) Human Factors for General Aviation	Jeppesen
3) JAA ATPL Book 08 Human Performance OAT & Limitations	
4) Air Transportation: A Management perspective	J.G.Wensvenn
5) Airline Operations & Scheduling	M. Bazargan
6) Aviation Security (Legal & Regulatory Aspects)	Abeyratne
7) Pilot Judgment & Crew Resource Management	Jensen
8) Aircraft Safety: Accident Investigations Analyses & Applications	Krause
9) Aviation & Airport Security	Sweet
10) Commercial Aviation Safety 3 / E	Wells
11) Vol. 06 Aviation Medicine & Survival	Royal Airforce Publications
12) Future Air Navigation System (FANS)	V.P.Galotti

Evaluation of Projects (Where ever Applicable)

- i) A student who passes in all the theory courses but does not secure minimum grade 'E' in project as applicable has to resubmit a fresh project till he/she secures a minimum grade 'E'. His/her marks and/or grades in the theory courses that the student has passed will be carried forward but he/she shall be entitled for grade "E" on passing.
- ii) The evaluation of project and viva-voce examination shall be by awarding grade in the seven point scale as given in (1) above.
- iii) A student shall have to obtain minimum of grade 'E' (or its equivalent marks) in project evaluation and viva/voce taken together. i.e. 40% marks in project work. The evaluation of project will be based on the following guidelines.

Guide lines for Project evaluation

Each project is of 25 marks

Project	Scope 20%	Exposition 40%	Originality 20%	Presentation 20%	Total
	5	10	5	5	25
Project 1					
Project 2					
Project 3					
Project 4					
Total	20	40	20	20	100

