

#105

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: AERONAUTICS 4

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CODE NO.: AVT200-4

SEMESTER: 4

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PROGRAM: AVIATION TECHNOLOGY (FLIGHT)

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AUTHOR: BILL GOVETT

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DATE: SEPT. 1991

PREVIOUS OUTLINE DATED: JUNE 1986

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APPROVED:

DEAN

*L. P. Chiquette*

DATE

*9/10/02*

COURSE NAME: AERONAUTICS 4

CODE NO. AVT200-4

TOTAL CREDIT HOURS

PREREQUISITE(S): Will hold a Private Pilot Licence and have satisfactorily completed semester three academics.

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**I. PHILOSOPHY/GOALS:** To teach the theory and practice of Aviation Technology, with emphasis in study toward the Commercial Pilot Licence Standard and attain a Grade of 70% or better overall and a 60% pass of all segments of the M.O.T. written Commercial Pilot Examination.

**II. STUDENT PERFORMANCE OBJECTIVES:**

Upon successful completion of this course the student will:

- 1) Be admitted to the fifth semester.
- 2)
- 3)
- 4)

**III. TOPICS TO BE COVERED:**

16 weeks - 4 periods per week  
13 periods Navigation  
16 Periods Meteorology  
6 periods Theory of Flight  
16 periods Air Regulations  
6 periods Air Frames and Engines  
4 periods Radio Aids  
3 periods Aircraft Systems (C172)

Total 64 periods.

NAVIGATION

METEOROLOGY

RADIO AIDS

THEORY OF FLIGHT

AIR REGULATIONS  
AIR TRAFFIC RULES &  
REGULATIONS

AIRFRAMES AND ENGINES

AIRCRAFT HANDLING AND  
OPERATING SYSTEMS  
(CESSNA 172)

From the Ground Up -  
A. F. MacDonald  
Study and Reference Guide  
for Commercial Pilots -  
Transport Canada  
Aeronautical Information  
Publication (A.I.P.) - Canada  
Flying Training Manual -  
Transport Canada  
Canada Flight Supplement GPH  
205 - Transport Canada

Low Altitude Enroute Charts GPH  
206 - Transport Canada

Charts - World Aeronautical  
~~Chart 1:500,000~~ 1:1,000,000  
- Air 5000 Series  
1:500,000

Down But Not Out  
Air Command Weather Manual  
(TP9352E)  
Air Command Weather Supplement  
(TP9353E)  
Pilots Operating Handbook  
Cessna 172N 1977

NAVIGATION

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1	2	Review of Definition Form of the Earth Time (Mean and Apparent) Direction True and Magnetic	FGU-Air Navigation S.C. Precis
2	1	Earth's Magnetism Compass Errors Airspeed and Altitude Indicators	FGU-Air Navigation
3	1	Maps and Charts Types of Charts	FGU-Air Navigation S.C. Precis
4	1	The Triangle of Velocities	FGU-Air Navigation S.C. Precis
Test	1	Variation of Deviation	
5	3	CR3 Computer for Commercial Navigation	CR Computer
6	1	Problem Work Sheet Pressure Pattern Flying	
EXAM	1	SEMESTER 4 FINAL EXAM	

SPECIFIC OBJECTIVES

1) Definition, Form of the Earth, Time, Direction True/Magnetic and the Earth's Magnetism.

The student is required as a thorough review, to know:

- a) Definitions.
- b) The Earth's shape specifics of latitude/longitude.
- c) The Arc of Time, time zones local and Greenwich.
- d) The Compass Rose and measurement of distance and track angle on Aeronautic Charts.
- e) The term Heading Track, bearing and associated problems.
- f) The reference to lines on a short relating to a great circle, small circle and rhumb line.
- g) The location of magnetic North and the North Pole and associated Magnetic meridian and the vector resolution.
- h) The reference to variation, isogonal agonic and the Residual magnetic error deviation and deviation card.

2) Earth's Magnetism, Compass errors, Airspeed and Altitude Indicators.

The student is required as a thorough review, to know:

- a) Terms associated with magnetic lines of force on the earth's surface, including the reference position of Magnetic North, dip variations (agonic and isogonal lines), residual magnetic error deviation and the deviation card.
- b) The construction of the magnetic compass, compass errors and the principles of gyroscopic action.
- c) Pressure measuring instruments, pilot and status pressure; with terms indicated, calibrated, rectified, true and equivalent regarding airspeed; and indicated calibrated pressure, density, true and absolute regarding altitude; computer solution to airspeed and altitude computation.

3) Maps and Charts, Types of Charts.

The student is required as a thorough review to know:

- a) The requirement of maps and charts, types and kinds,, scales with reference to great circle and rhumb lines.
- b) The types of charts used in Canada, chart characteristics, symbols and signals, dated chart information, and radius facility charts and supplement usage.

4) The Triangle of Velocities.

The student is required as a thorough review to know:

- a) And define Heading Track (course) and wind vector.
- b) Define vectors true magnetic compass.
- c) Speed distance and bearing formula.

5) Jeppesen CR5 Computer for Commercial Navigation

The student is required to know:

- a) Airspeed and altitude nomenclature.
- b) Computer procedure to find airspeeds and altitudes as defined.
- c) Method new and old conversion to TAS.
- d) Use of circular slide rule in determining multiplication, division proportions and solution of airspeed formula.
- e) Affective usage of the wind computing side of the flight computer.
- f) The solution to problems applicable to the CR5 computer.

6) Pressure Pattern Flying

This system is used in conjunction with other long range navigational systems and is given to make the student aware, give an understanding and demonstrate the use of forecast and in flight information relative to the pressure field at the cruising level of the aircraft. The student is required to know:

- a) The application of pressure pattern information and the difference of "D" factor between the absolute and pressure altitudes.
- b) The Bellamy draft formula.
- c) The method of determining the crosswind component "Vn" and problem solution by formula.
- d) The method of determining the crosswind displacement "Zn" and problem by formula.

METEOROLOGY

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1,2,3	1	Atmosphere Clouds Pressure	Weather ways - Ch 2
4,5	1	Winds Moisture & Temperature	
6,7	1	Stability & Instability Air Masses	
8	1	The Structure of Fronts	
TEST	1	TEST ON REVIEW WORK COVERED TO DATE.	
REVIEW	1	TEST REVIEW	Weather Ways - Ch 1- 9
9	1	Weather at the Cold Front	Weather Ways - Ch 10 Supplement to Weather Ways - Ch 10
10	1	Weather at the Warm Front	Air Command Weather
11,12	1	Weather at Trowals and Upper Fronts Cloud, Precipitation and Fog	Air Command Supplement
12,13	1	Clouds, Precipitation and Fog Visibility	
14,15	1	Ice Accretion Thunderstorms	
16,17,18	1	Turbulence Precipitation Static Mountain Waves	
EXERCISE	1	Maps, Forecasts, Observations	
TEST	1	SEMESTER <sup>5</sup> FINAL <sub>4</sub>	

SPECIFIC OBJECTIVES

1) Atmosphere

The student is required to know:

- a) the significance of atmospheric models
- b) extent of the atmosphere
- c) composition of the atmosphere
- d) properties of the atmosphere
- e) divisions of the atmosphere
- f) details of the ICAO atmosphere

2) Clouds

The student is required to know:

- a) the International Cloud Classification
- b) appearance of the main cloud forms
- c) direct and indirect significance of each cloud form to aviation

3) Pressure

The student is required to know:

- a) the definition of "pressure" as applied to the atmosphere
- b) the meaning of the terms "station pressure, sea level pressure, and altimeter setting"
- c) the nature of the horizontal pressure differences at a given time
- d) the meaning of "pressure gradient"
- e) the nature of pressure changes at a station over a period of time
- f) the meaning of "pressure level" and the cause of variations in the altitude of pressure levels
- g) how pressure altimeters work and the nature of their errors owing to pressure and temperature variations
- h) how to identify and interpret pressure information provided on surface and upper air maps

4) Winds

The student is required to know:

- a) the meaning of "wind direction" and the terms "veering and backing" as applied to changes in wind direction
- b) the nature of the forces which cause and effect the direction and speed of the motion
- c) the relationship between the MSL pressure patterns and the lower level winds



- d) the main situations in which the surface wind does not conform to the MSL pressure systems
- e) the nature of wind at higher levels
- f) the relationship between winds as observed in flight and altimeter errors
- g) how to identify and interpret wind information depicted on surface and upper air maps

5) Moisture and Temperature

The student is required to know:

- a) the scales used to express temperature
- b) the importance of moisture in the air
- c) how the atmosphere is heated
- d) how the atmosphere is cooled
- e) how cooling and heating the atmosphere affect weather

6) Stability and Instability

The student is required to know:

- a) the meaning of "stability" and "instability"
- b) the relationship between lapse rate and stability
- c) modification of stability
- d) characteristics of stable and unstable air
- e) the main lifting processes which affect the atmosphere

7) Air Masses

The student is required to know:

- a) the meaning of "air mass"
- b) how the characteristic conditions of an air mass develop
- c) how air masses are classified
- d) factors which determine weather in an air mass
- e) the main characteristics of the principle air masses which affect North America

8) The Structure of Fronts

The student is required to know:

- a) the three dimensional arrangement of air masses
- b) the types of fronts

- c) the meaning of "Frontogenesis" and Frontolysis"
- d) the relationship between fronts and pressure distribution
- e) the main stages in the life history of a frontal depression
- f) the symbols and colours which identify fronts on the weather map
- g) how to identify and interpret information relating to frontal depressions on the weather map

9) Weather at the Cold Front

The student is required to know:

- a) the air mass structure at the cold front
- b) the factors which determine weather at a cold front
- c) the general nature of surface weather changes associated with a cold front
- d) how to recognize cold frontal systems during flight
- e) main problems associated with flight through cold fronts

10) Weather at the Warm Front

The student is required to know:

- a) the air mass structure at the warm front
- b) the factors which determine the weather at a warm front
- c) the general nature of surface weather changes associated with a warm front
- d) how to recognize warm frontal systems during flight
- e) main problems associated with flight through warm fronts

11) Weather at Trowals and Upper Fronts

The student is required to know:

- a) the air mass structure at the Trowal
- b) the general nature of weather at occlusions, trowals and upper fronts

12) Clouds, Precipitation and Fog

The student is required to know:

- a) the requirements for condensation

- b) the meaning of "sublimation"
- c) how clouds form
- d) how precipitation develops, the relationship between turbulence
- e) how to identify different forms of precipitation
- f) how fog forms, the principle types of fog and the characteristics of each
- g) symbols and abbreviations used for cloud types, precipitation and fog

13) Visibility

The student is required to know:

- a) the meaning of "visibility" as applied to surface and air observations
- b) conditions that cause restricted visibility

14) Ice Accretion

The student is required to know:

- a) the effects of icing on aircraft performance
- b) details of icing as it occurs in clear air
- c) how ice forms in cloud and precipitation
- d) types of icing to be found in cloud and precipitation
- e) icing intensity
- f) details of engine icing
- g) aircraft deicing and anti-icing systems
- h) how icing affects helicopters

15) Thunderstorms

The student is required to know:

- a) the requirements for thunderstorm development
- b) the structure and development of a thunderstorm
- c) types of thunderstorms
- d) surface weather changes associated with thunderstorms
- e) effects of thunderstorms on flight

16) Turbulence

The student is required to know:

- a) the causes and effects of turbulence

17) Precipitation

The student is required to know:

- a) weather conditions which favour precipitation static

18) Mountain Waves

The student is required to know:

- a) the features of mountain waves
- b) effects of mountain waves on aviation
- c) the guiding rules for planning flights in mountain regions

RADIO AIDS

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1	3	VOR Operation & Use	From the Ground Up
2	3	ADF Operation & Use	From the Ground Up
3	1	VFR Charts	DOT VFR Charts
4	1	Review	
5	1	SEMESTER FINAL EXAM	

SPECIFIC OBJECTIVES

1) VOR Operation and Use

The student is required to know:

- a) mechanics of the VOR system
- b) orientation by VOR
- c) pre-determined tracking using VOR
- d) time and distance by VOR

2) ADF Operation and Use

The student is required to know:

- a) mechanics of the ADF system
- b) orientation by ADF
- c) pre-determined tracking using ADF
- d) time and distance by ADF

3) VFR Navigation Charts

The student is required to know:

- a) the use of VFR charts for navigation by VOR and ADF

THEORY OF FLIGHT

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1,2	1	Atmosphere, Pressure and Airports Lift, Drag, Thrust & Weight	FGU-Theory of Flight
3,4	2	The Center of Gravity and Weight and Balance, Part 1 and 2 - Forces acting on an airplane during flight	FGU-Theory of Flight
5,6	2	Airspeed limitations and Wing tip vortices	FGU-Theory of Flight
7	1	SEMESTER FINAL EXAM	

SPECIFIC OBJECTIVES

1) Atmosphere, Pressure and Airports

The student is required as a thorough review to know:

- a) the standard atmosphere, pressure to altitude and viscosity as related to theory of flight
- b) Bernovilli's Theorem angle of attack and centre of pressure
- c) the theory of a wing in flight, camber chord and span, the resolution of forces

2) Lift, Drag, Thrust, and Weight

The student is required as a thorough review to know:

- a) the lift drag formula and its relation to flight
- b) the types of drag
- c) the effect of couples to flight
- d) stability (Cof. G., Cof. P)

3) The Centre of Gravity, Weight and Balance

The student is required as a thorough review to know:

- a) the centre of gravity as associated with the three axis and planes
- b) the principles, definitions and practical applications

4) Forces Acting on an Airplane During Flight

The student is required as a thorough review to know:

- a) the effect of slipstream, asymmetric thrust, torque, and gyroscopic action
- b) the laws of motion
- c) the effect of controls, balance, dynamic and static
- d) the types of ailerons, flaps, slots and slats
- e) the effects of dihedral, anhedral
- f) the theory for autorotation and to include the stall incipient and full spin
- g) the forces in a turn and the relation of speed to turn and bank
- h) the relation of wing loading to density and speed



5) Speed Limitations and Wing Tip Vortices

The student is required as a thorough review to know:

- a) reasons for speed limitations, turbulence, stall, flaps, best angle, best rate and normal rate, maneuvering speed, structural cruise speed and never exceed speed
- b) wing tip vortices, large, small aircraft and speed relationships

Air Regulations, Air Traffic Rules and Regulations

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1,2	5	Air Regulations and Review	Air Regulations and Aeronautics Act Pt. 1 - VIII Air Navigation Orders Series I, II, III, IV, V A.I.P. Canada
3,4	3	General, Aerodromes, Communications	A.I.P. Canada - Gen, Com VFR Chart Supplement
5,6	3	Rules of the Air, Air Traffic Services Search and Rescue	A.I.P. Canada - RAC, SAR
TEST	1	SEMESTER FINAL EXAM	

SPECIFIC OBJECTIVES

1,2) Air Regulations and Air Navigation Orders

The student is required to be fully familiar with:

- a) definitions and terminology
- b) aerodrome personnel licensing and Air Traffic Regulations
- c) Rules of the air
- d) aeronautics act
- e) air navigation orders series I through V

3,4 General, Aerodromes, Communications

The student is required to be fully familiar with:

- a) General - aeronautical terms and abbreviations
  - time zones
  - units of measurement and conversions
  - aircraft markings
- b) Aerodromes - administration
  - design criteria
  - visual aids and lighting
  - military arrestor cables, maintenance and emergency services
  - regulatory information
- c) Communications - areas of responsibility
  - radio navigation aids
  - mobile services

5,6 Rules of the Air, Air Traffic Services, Search and Rescue

The student is required to be fully familiar with:

- a) Rules of the air and traffic services
  - general rules and services
  - airspace requirement
  - flight planning and enroute procedures
  - airport operations
- b) Search and Rescue - responsible authority
  - flight planning
  - emergency procedures
  - safety and investigation

TOPIC NO. SUGGESTED PERIODS OPERATING SYSTEMATION

REFERENCE

1	3	Cessna 172 Operating Procedures	Cessna 1977 Pilots Operating Handbook
		Cessna 172 Check List	Sault College Cessna 150, 152, 172 Check List Handout
		Cessna 172 Speed Chart	Sault College Cessna 150, 152, 172 Speed Chart Handout

TEST

FINAL SYSTEMS WRITTEN EXAMINATION  
- CESSNA 172

SPECIFIC OBJECTIVES

Definition:

The student is required to know:

- aircraft performance - specifications
- basic aircraft data and information including definitions or explanations of symbols, abbreviations and terminology commonly used
- operating limitations instrument markings basic placards necessary for safe operation and the aeroplane, its engines, standard systems and equipment
- emergency procedures
- normal procedures
- performance data and charts
- weight and balance equipment list
- aeroplane and system description
- handling and system description
- handling, service and maintenance

SURVIVAL TECHNIQUES

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1	2	Survival Techniques	Down But Not Out Defensive Flying, Section 3 Search & Rescue Atlantic Area Pg. 19 - 28 Cold Injuries (Handout)
2	24 hrs.	Practical Survival Field Trips	

SPECIFIC OBJECTIVES

- a) psychological aspects of survival
- b) basic knowledge
- c) personal survival kit
- d) establishing priorities
- e) constructing a shelter
- f) lighting a fire
- g) signalling
- h) personal welfare
- i) hunting
- j) fishing
- k) cooking
- l) improvisation
- m) blazing and direction finding

2) Practical Survival

The student is required to participate in a practical survival trip of 24 hours duration. He is required to construct a shelter and fire and subsist on little or no rations during the period of the survival exercise. He will be given practical instruction in all of the sub-topics covered in topic #1.

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RADIO AIDS

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1	1	VOR Operation & Use	From the Ground Up
2	2	ADF Operation & Use	From the Ground Up
3	1	VFR Charts	DOT VFR Charts
4	1	Review	
5	1	SEMESTER FINAL	
6	5	IFR Charts	DOT Enroute Low Altitude Charts
7	2	The Flight Supplement	DOT - Flight Supplement
8	2	Review	
9	1	Final Semester Exam	
10	1	DOT Commercial Pilot Examination	



SPECIFIC OBJECTIVES

1) VOR Operation and Use

The student is required to know:

- a) mechanics of the VOR system
- b) orientation by VOR
- c) pre-determined tracking using VOR
- d) time and distance by VOR

2) ADF Operation and Use

The student is required to know:

- a) mechanics of the ADF system
- b) orientation by ADF
- c) pre-determined tracking using ADF
- d) time and distance by ADF

3) VFR Navigation Charts

The student is required to know:

- a) the use of VFR charts for navigation by VOR

4) The Flight Supplement

The student is required to know:

- a) what information is in the "Supplement"
- b) how to use the available information

AIR FRAMES AND ENGINES

<u>TOPIC NO.</u>	<u>SUGGESTED PERIODS</u>	<u>TOPIC DESCRIPTION</u>	<u>REFERENCE</u>
1	3	Air Frame	F.G.U. Air Frame
		MID-TERM EXAM	
2	3	Aero Engines	F.G.U. Aero Engines

FINAL AIR FRAME AND ENGINES EXAM

SPECIFIC OBJECTIVES

The student is required to know:

1) Air Frame Design

- nomenclature
- streamlining and speed
- relation lift and drag and methods to reduce
- loads and stresses

2) Construction

- types
- controls and locations
- landing gear types and purpose of shocks

3) Parts as relate to C152, C172

4) Aero Engine

- combustion cycle
- four stroke and two stroke
- cooling lubrication
- wet and dry sump

5) Aero Engine Carburation

- purpose
- icing
- theory turbo chargers and super charges

6) Electrical Systems

- airframe electrical systems
- aero engine electrical systems

7) Aero Engine Propeller

- purpose
- efficiency

8) Aero Engine Operation

- handling
- starting
- safety

COURSE NAME: Aeronautics

CODE NO. AVT200-4

V. **EVALUATION METHODS:** (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.)

The student will be assessed by test following a block of subject matter, with a mid-term final examination and a semester final. Credit for block tests and mid-term will be weighted and applied to the final semester grade.

These tests will be in addition to the Transport Canada Commercial Examination (minimum 70%).

**FLYING:**

- assessment is continuous, based on instructor evaluation and documented by progress books
- periodic progress checks with faculty to determine suitability to continue
- private or commercial pilot flight test or progress check at the end of the semester

**ACADEMIC:**

- all AVT200 subjects are grouped together. Test results are totalled and reduced to a percentage for mid-term and final marks. Each subject is weighted with the greatest emphasis placed on navigation and meteorology and air regulations. Tests are normally conducted periodically at the end of each block of instruction with approximately 50% of the grade based on tests and 50% on final. 50% of the value of the end of semester total will be derived from mid-term grades.

**MID-TERM:**

*FINAL* - NAV100, MET100, Radio Aids 50, T of F 50, Air Regs 100, A/C systems 50 = 450 marks reduced to a percentage

**GRADE:**

A+	-	93	-	100%
A	-	87	-	92%
B	-	80	-	86%
C	-	70	-	79%
I	-	Below 70	(Mid-Term Only)	
X	-	Below 70	(final extenuating circumstances only)	
R	-	Below 70%		

- In the event of a failure in one AVT subject, the highest grade achievable will be a "C". Failure of two or more AVT subjects will result in an "R" Grade.
- A 2.8 G.P.A. is considered minimum acceptable and student progress will be reviewed if below that grade.
- D.O.T. exams are not included in college grades although minimum of 70% as well as a pass of all segments is required to continue on course. An "R" grade will be awarded for AVT in the event of a failure.
- "R" grades in any subject at the end of a semester will result in termination from the program.
- Attendance is mandatory for all Aviation classes.
- Although attitude, co-operation, etc., are not graded, students may be terminated based on their performance in this area. These attributes are also considered in the selection of the Air Canada Award and other scholarships.
- Firm dates have not been established for tests because a good deal of instruction takes place on bad weather days.

**VI. REQUIRED STUDENT RESOURCES**

As per book list.

**VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:**

Book Section (TITLE, PUBLISHER, EDITION, DATE, LIBRARY CALL NUMBER IF APPLICABLE - SEE ATTACHED EXAMPLE)

Periodical Section (MAGAZINES, ARTICLES)

Audiovisual Section (FILMS, FILMSTRIPS, TRANSPARENCIES)

**VIII. SPECIAL NOTES**

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.