**1. Aero-Science**

**B.Sc. Aero Science-II** **Total Mark: 100**

**Appendix 'A'**

**(Outlines of Tests)**

Navigation : 100 Marks

**Note:-** The questions will be set in each paper. Candidates are to attempt any five except in Paper B in which the question on Computer will be compulsory

**Appendix 'B'**

**(Outlines of Tests)**

**Navigation** **100 Marks**

**1. Introduction:**

(a) The purpose and importance of aerial Navigation.

*(b)* The definition of five types of aerial Navigation *i.e.*

i. Contract or visual.
ii. Radio.
iii. Radar.
iv. Astro.
v. Dead. Reckoning.
vi. Interial Navigation.

(c) The dimensions of Navigation

**2. The form of the Earth:**

(a) The shape of the earth.

(b) The rotation of the earth.

*(c)* The representation of various lines on the surface of the earth and the use of

i. Great circle.
ii. Small circle.
iii. Meridian.
iv. Equators.
v. Latitude.
vi. Longitude.
vii. Rhumb Line.

(a) Position and Comparison of Position *:*

i. Change of longitude.

ii. Change of latitude.

iii. Solution of Problems.

**3. Distance and Their Measurements:**

*(a)* Distance Measurement :

i. Nautical miles.

ii. Statute miles.

iii. Kilo Meter.

(b) Inter conversion of units.

**4. Direction on the earth :**

(a) Angular measurement.

(b) True direction.

(c) Magnetic direction.

(d) Variation.

(e) Iso gonal.

(f) Compass direction.

(g) Deviation.

(h) Heading-Compass-Magnetic-True (Problems).

**5. Elementary Definitions :**

(a) Heading.

(b) Course.

(c) Draft.

(d) Track

(e) Air Speed*:*

(i) I.A.S.

(ii) C.A S.

(iii) E.A.S.

(iv) T.A.S.

f. Ground speed.

g. Bearing.

h. Relative Bearing.

i. Ground position.

j. Pin Point.

k. fix.

l. Height.

m. Elevation.

n. Altitude.

**6. Methods of Reporting Position:**

a. The place-name -method and its illustration

b. The bearing distance method.

c. The latitude and longitude method

**7. Pressure Instruments :**

a. The Principle, construction and errors of the air speed indicator.

b. The Principle, construction and errors of the altimeter.

c. The solution of altimeter problem.

d. The Principle, construction and errors of V.Y.I.

e. Conversion of Mach No. to Speed

**8. Map Projections :**

a. The properties of an Ideal projection.

b. Stages in map construction.

c. The types of projections-concial-aximuthal cylindrical-Mathematical

*d.* Azimuthal Projection*:*

i. Polan Gnomonic.

ii. Equitorial Gnomonic.

iii. Oblique Gnomonic.

*e.* Cylindrical Projections:

i. Mercator's Projection.

*f.* Topographical Projections:

i. I.M.P.

ii. Lamberts conformal.

g. Measurement of direction and distance on I.M.P. Lambert's conformal, Composite problems.

**9. Map Reading No. 1 & 2:**

a. The relief on the earth’s surface and its representation on a map.

b. The representation of scale by :
    i. Representative fraction.
    ii. Statement in words.
    iii. Graduated scale.

c. The relative value of ground features on maps.

d. Conventional signs on IMP and lambert's conformal.

e. The technique of map reading when visibility is poor and when uncertain of position.

f. The technique of map reading at night.

g. The technique of map reading at low and high level.

**10. Magnetism :**

a. Revision of basic theory of magnetism.

b. The earth's magnetic field.

c. The resolution of the earth's magnetic field into components.

d. The effect of components of a magnet.

e. Ali craft magnetism.

f. The resolution of components of aircraft magnetism.

g. The derivation of co-efficients.

h. The compass swing.

**11. Compass No. 1**

a. The B-*16* Compass*:*
    i. Construction.
    ii. Errors and limitations.
    iii. Pre-flight check.

b. *The J-2* Compass *:*
    i. Construction.
    ii. Pre-flight checks.
    iii. Errors and limitations.
    iv. R.M.I.

**12. Computer :**

a. The need and purpose of the computer.

b. Solution of:

i. Multiplication and division problems on the computer.
ii. Time distance and speed problems *(iii)* Fuel consumption problems.
iii. True Air Speed problems.
iv. The Attitude problems.

a. Conversion of*:*
i. Units on the computer.
ii. Speed to Mach No. and vice, versa.

b. Computing of heading, drift and ground speed, composite problems.

**13. Last Procedure :**

a. Causes of error in Navigation.
b. The procedure of fuel saving to be adopted when uncertain of position.
c. To make use of radio aids if uncertain of position.
d. General lost procedure.

**14. Pilot Navigation:**

a. Use of the'One in Sixty Rule'.
b. Sowing the problems of 'One in Sixty Rule' on the Computer.
*c.* Gain or lose time by :
i. The 'dog leg'.
ii. By change of I.A.S.
iii. By 'S' turns and 3600 turns.

a. Use of position lines for Navigation.
b. Use of radio and radar fixes for Navigation.

**15. Flight Documents:**

a. The flight information publication A.F.M. 96-5 and its use in flight planning.
b. The high and low level led down charts.

**16. Radio Navigation Aids**:

a. The assistance provided by U.D.F. station.
b. The use of fixer stations and typed of fixes.
c. Navigation assistance provided by G.C.I. units.
d. Radio Compass
e. V.O.R.
f. Tacan.
g. G.C.A,
h. I.L.S.

**17. Radio Navigation:**

a. How homing is carried out with the help of Radio Compass,
b. How tracking out is carried out with the help of Radio Compass.
c. The distance time to a radio facility with the help of change of bearing.

**18. Pre-Flight Planning:**

a. The importance and need of the following for planning.
    i. Met Briefing.
    ii. Selection of maps.
    iii. Selection of Route.
    iv. Method of calculation of safety attitude.
    v. Medium level and high level separation system.
a. The local radio and radar sites.
b. The local prohibited, danger and restricted areas.

**19. Flight Planning No. 2**

a. Use of the dash one for flight planning.
b. To plan a long Navigation cross country.
c. To plan a mission involving climb and descent on trach.

**20. Low Level Navigation :**

a. The problems peculerto low level missions particularly to high fuel consumption in Jet aircraft.
b. To plan a typical low level navigation mission.
c. The difficulties involved in recognising ground features during low level mission.

**21. Composite Problems High Attitude Navigation:**

a. The effect of high wind associated with high attitude.
b. The need for calculating mean wind for climb and descent.
c. The effect of aircraft speed on drift angle.

**22. High-Law-High Mission Planning** :

**23. Tactical Navigation :**

a. The critical point (C.P.) and its solution by graph and formula.

b. The Radius of action problem(ROA)and its selection by graph and prohibited,
c. The point of no return(P.N.R.)and the difference between P.N.R. and R.O.A.
d. Searches and Reasons (different types of Search).

**24. Cruise Control :**

a. Constant Power.
b. Constant Speed.
c. Max. Edurance.
d. Max. Range.

**25. Concept of Celestial Navigation :**

a. The celestial sphere and its coordinates.
b. Rotation and revolution.
c. Seasons.
d. Celestial coordinates.
e. Altitude & Azimuth.
f. Celestial fix.

**26. Time :**

a. The following definite of time:
    i. Year.
    ii. Day.
b. The following type of time and their interconversion:
    i. Local mean time.
    ii. Greenwich mean time.
    iii. Standard time.
    iv. Zone time.
    v. The International Date line.
    vi. The calculation of sunrise and sunset time with the help of A.F.M. 96-5.

**27. Modern Navigation Techniques :**

a. Doppler's Principle.
b. Rader P.P.l.
c. Inertinal Navigation system.
d. Omege.
e. Astro Tracker.