INDEX

SPECIALISED SYLLABUS – JD

1. General Service Knowledge (GSK)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	GSK-1	Development of Aviation	1	L,F			1
2	GSK-2	History of IAF	1	L,F			1
3	GSK-3	Organisation of Air Force	1	L			1
4	GSK-4	Branches of the IAF	1	L			1
5	GSK-5	Career in the IAF as an Officer/Airman	1	L			1
		Total	**5**				**5**

2. Air Campaigns(AC)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	AC-1	Indo Pak War 1971	2	L,F			2
2	AC-2	Op Safed Sagar			2	L,F	2
3	AC-3	Motivational Movies			4	F	4
		Total	**2**		**6**		**8**

3. Aircraft Recognition (ACR)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	ACR-1	Helicopters			1	L,P	1
2	ACR-2	Transports			1	L,P	1
3	ACR-3	Fighters			1	L,P	1
		Total			**3**		**3**

PRINCIPLES OF FLIGHT (PF)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	PF-1	Introduction	1	L			1
2	PF-2	Glossary of Terms	1	L			1
3	PF-3	Forces on an Aircraft	1	L			1
		Total	3				3

PARTS OF AN AIRCRAFT (PA)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	PA-1	Parts of an Aircraft	2	L,P			2
		Total	2				2

AIRCRAFT PARTICULARS (AP)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	AP-1	Aircraft Particulars (Type specific	1	L,P			1
		Total	1				1

AIRFIELD LAYOUT (AL)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	AL-1	Airfield Layout	1	L			1
		Total	1				1

ATMOSPHERE (MET)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	MET-1	Atmosphere			1	L	1
		Total			1		1

MAPS (MP)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	MP-1	Maps			1	L	1
		Total			1		1

RT PROCEDURE (RT)

Ser No	Code	Subject	1st yr	Type	2nd yr	Type	Total periods
1	RT-1	RT Procedure	2	L,P			2
		Total	2				2

AEROMODELLING (AM)							
Ser No	**Code**	**Subject**	**1st yr**	**Type**	**2nd yr**	**Type**	**Total periods**
1	AM-1	History of Aeromodelling	1	L			1
2	AM-2	Materials used in Aeromodelling	1	L			1
3	Am-3	Types of Aeromoels	1	L			1
4	AM-4	Flying/ Building of Aeromodels	16	D,P	24	D,P	40
		Total	19		24		43
Grand Total			35		35		70

CHAPTER – I
GENERAL SERVICE KNOWLEDGE

DEVELOPMENT OF AVIATION

Period - GSK-1

Type - Lecture

Term - Ist year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker

Time Plan

2.	(a) Introduction	-	05 minutes
	(b) Explanation	-	32 minutes
	(c) Conclusion	-	03 minutes
	Total	**-**	**40 minutes**

INTRODUCTION

1. The idea of human flight has engaged the thought of many men since the beginning of history. Tracing the evolution of flight, one gets into a world of myths, religious beliefs and legends, when some of form of flying was visualized in the encounter and affairs of ancient life. There are the Vimanas of flying chariots in Indian mythology, the winged deities from Egypt and Assyria, the magic carpet from Arabia, the winged horse Pegasus and winged cap and heals of Hermes in Roman and Greek mythology. Mythologies aside, the first scientific venture in aviation were the tentative steps made in the fourth century B.C in China that eventually led to invention of the kite by the sixth century B.C, kites had found their way in military applications.

2. In 1890 LILIENTHAL in Germany started riding the air in gliders and it was his example, which fired the imagination of Wright brothers in America and turned their attention to solving the practical problems of aviation .The Balloon was joined by the parachute in 1797 when the French man, GARAERIN made the first human at PARIS. In 1852 the stream driven Airship became feasible, and also the light pressure ship of SANTOS and DUMONT.

3. The power airplane took ten years (1895-1905) to emerge from the Glider, which was perfected by the Wright Brothers. In 1906 Wright Flyer 111 emerged which could be banked, turned, circled and flown with ease and which could comfortably stay in the air for more than half an hour at a time.

AIM

4. To teach the NCC cadets about the development of aviation.

5. One of the earliest attempts to construct a flying machine was made by Leonardo Da Vinci, the genius of renaissance period, known for his attempt to design a mechanical device using arms and legs which activated flapping wings through system f pulleys and livers. The machine was called Ornithopter which implies **flapping wing.** This was a flapping wing aircraft powered by human body. Leonardo Da Vinci also designed a screw-copter, the first real concept of the modern helicopter, but even he could not achieve much headway.

6. Francesco Delana-Terzi proposed the first serious project for a lighter aircraft in 1670. It was intended that four thin copper spheres from which all the air had extracted, would lift such an aircraft. Arrival of the balloon as a lighter than air vehicle was a land mark of flight. Two brothers Joseph and Etienne Montgolfier made the first managed lighter than air flight in 1782, while watching a fire in his fire place, Joseph had became interested in the force that caused the spark and smoke to rise. He made a small bag out of silk and lit a fire under the opening at the bottom, so causing it to rise. The brothers thought that such burning created a gas which they called Montgolfier Gas in June 1783. The brothers put on their n first public demonstration using a paper lined linen bag 30 feet in diameter. The balloon rose to an altitude of 6000 feet and travelled for over a mile before landing.

7. Sir George Cayley, known as the father of aerial navigation designed the first airplane with wings, fuselage, tail unit and a means of propulsion in 1799. In 1804 he flew the first model airplane which had a kite's shaped wing mounted on a pole with a universally jointed tail unit. Five years later he constructed a full sized Glider which was flown successfully, first unmanned and then with a boy just over a few yards. Much experimentation with Gliders kites and various propulsion systems followed in the 19th century until the first successful manned flight by Orville Wright in 17 December 1903. In 1906, a first flight in Europe was made by the Brazilian, Alborto Santos Dumont over the Bagatelle Park in Paris.

8. Invention of the airship was the next major step in man's endeavours. The LA France, built by Renard and Kareves in 1884. The first flight was in September 1928 and this pioneer passenger travelled over the Atlantic long before air planes was capable of long range flight. The Zeppline of Friedrichsafen in southern Germany built a series of air ship between 1900 and 1936.

9. At the beginning when Orville Wright first experienced a drift in body velocity and felt the defiance of gravity during his flight on 17 December 1903 at Kitty Hawk North Carolina. He was not merely proving yet another of man scientific endeavors into the

unknown. His brother Wilbur and he had in fact achieved man's aeons old yearning to fly like a bird and defy the laws of gravity and air current elements of nature believed not to be under his control till then. Three flights on covering over a half a mile the Wright flyer had achieved the first over flight by heavier than aircraft in the recorded history. Men's urge to fly goes back to his earliest observation of birds. The effortless act of flying accomplished by the species drew him to the dynamics of gravity and the air.

10. The first Indian aviator both pilot and aircraft constructor was Prof Venketa Subba Setty of Mysore who was a remarkable person, being the first Indian to fly, and as a pioneer in aeronautical engineer, to design, build and fly an aircraft. This was on 16 June 1912, while he was with A.V Roe and CO (Avro) at Brooklands in the Manchester area of England. VS Setty had joined A.V Roe on 08 May 1911 as a time keeper and within some weeks on 27 May 1911 along with another Indian SV Sippe began to practice for flight in a Gnome powered Farman pusher biplane. Within some months he had rolled (flown) in a 35 H.P Viale engined Avro type D (No.6). On 27 September 1911 Setty had his first flying incident ending up in the sewage farm adjacent to Brooklands which happened frequently to early aviators and Setty ended up there again on 21 February 1912 while flying on Avro type B; but was uninjured. Prof Setty's interests included automobiles, he participated in car races in the U.K and first Indian on a motor cycle born in 1879, this pioneer of aviation only lived till the age of 39, passing away in 1918. There was barely any aviation activity in India during years of the Great War. However a central flying school had been set up in Sitapur on 1 October 1915 under the control of Army HQ with the object of Officers gaining experience under Indian conditions, with some five air planes in service. Individual Indian aviator had, however engaged themselves in aviation pursuits when they managed to enlist in the Royal Flying Course. Lt Hardeep Singh Malik, Lt Indra Lal Roy, D.F.C and Lt SG Welingkar, M.C, where amongst the Indian in the RFC. Although the First World War had disrupted the development of aviation in India, it had given an opportunity for these young pilots to distinguish themselves. Lt Indra Lal Roy was one of the first Indian to receive the king's commission at the age of 18. He was with No.56 Squadron RFC on the western front and No 40 Squadron during July 1918 shooting down several German fighters. Sardar Hardeep Singh Malik who was later to be Indian Ambassador to Paris served in both the RFC and RAF. He had joined the RFC in April 1917, later was in operation with No.28 Squadron and flew Sopwith Camels as a fighter pilot. In 1913 there was about five air machines in India. There was no pilot apart from a few British Officers of the Indian Army who had learned to fly in England in 1915. At the end of the First World War Royal Air Force as the largest bomber in the world.

11. Civil aviation in India picked up soon when intercontinental flights started between Europe and India. As part of British Empire the initiative for development of the aviation, civil and military in India was naturally the prerogative of the British

government. One of Britain's immediate objectives was to have independent air route to India. With Seften Brancker being director of civil aviation during this period, India naturally became the focus point in British aviation plans. Seften Brancker's ambitious plans for intercontinental air links were realized when, on 17 March 1925, he flew aboard a D.H 50 from Croyvon terminal in London to Rangoon in Burma and returned back, thereby completing an 8000 miles air trip to India and back. This adventures expedition laid the foundation for intercontinental civil air services. However the first proving flight of KLM Royal Dutch Air lines to Java, passed through India even before Brancker took off from London. The KLM flight landed in Karachi on 9 November 1924. The directorate of civil aviation was established in 1927 as an integral part of the department of industries and labour, Lt Col Shelmderdine being appointed as the first director of civil aviation. His first priority was the creation of chain of aerodromes with good permanent hangars incorporating workshops and offices on the Karachi-Calcutta and Karachi-Southern India routes. Another vital task to be accomplished was establishing a wireless communication network and direction finding station, comprising point to point communication on the entire route. Shelmderdine spent considerable time in organizing the state owned India state air services to operate the Indian sector of the entire route between London and Far East. He was also the person pushing for establishing flying clubs across the country as also the aero club of India.

12. Among the early aviators of India, there was an elite class of incredibly talented flying enthusiastic who contributed majorly to the growth and sustenance of aviation in India. There were A.M Engineer, popularly known as ASPY, Man Mohan Singh and JRD Tata. Born on 15 December 1912, A.M Engineer was, at 17 the youngest Indian pilot of the time. He won the Aga Khan Trophy being the first Indian to fly solo from England to India in a Gypsy Moth. Later, he trained at RAF Cranwel where he was adjudged the best all-round cadet was commissioned in to A Flight of IAF, and flew the Wapitis in the North Western frontier province. No 1 Squadron was formed in July 1938, Engineer was appointed the Flight Commander and flew operations in North Waziristan in May 1939. A flight under Engineer's command carried out 403 hours of flying operation, a feat which was acknowledged as remarkable in view of the small number of aircraft and crew available.

13. Another distinguished aviator who became a legend in Indian aviation history was Man Mohan Singh a remarkable person. An engineer from Bristol University, he was the first Indian to fly solo from England to India. He had earlier completed a two years course in flying and aeronautical engineering at Bristol on an Indian government scholarship. In 1934-35 Man Mohan Singh accomplished another solo flight in a light aircraft, again the first by an Indian, from England to South Africa.

14. J.R.D Tata, was the first Indian to secure an A-license within the shortest number of the hours and is perhaps the most acclaimed personality of Indian aviation, the

visionary who laid the foundation for commercial air transport in India. The passion for flying was kindled in him from the legendary Bleriot, the first man to fly across the English Channel. J.R.D's first flight during his childhood days was with a joy-riding pilot in Hardelot. The first entry in his flight logbook was on 22 January 1929 when he made his first flight in a Gypsy Moth at the Bombay flying Club, done remarkable after only 12 days 3 hours and 45 minutes of dual flying experience at the flying club. He lost his air lines service on 15 October 1932 with a Push Moth airmail service to Karachi in 1938 at the age of 34. The pioneering efforts by the house of Tata's ably assisted and nourished by Neville Vintcent, a former RAF pilot who came to India in 1929 and built up the aviation department of Tata Sons as a full fledged domestic air line service which was, two turbulent decades later to evolve into the country's international career, Air India International in 1948.

Lay out of chronological development

Year	Event
1799-1809	George Cayley laid the foundation for the field of Ariel Navigation, Balloons were tried
1890-	Lilienthal discovered gliders
1895-1905	Wright flier 111 was developed
1910	Roe's bi- plane appeared
1919	Rolls –Royce engine was developed
1928	Hele-Shaw –Beachan propeller was designed
1941	Whittle W-1Turbo Jet was developed
1942	Germans V-2Rocket engine
1947	Bristol centaurs engine was designed
1954	Rolls- Royse Vertical test rig was developed

CONCLUSION

15. We have seen here the chronological development of aviation from beginning to era where man flies with the help of machines.

HISTORY OF IAF

Period - GSK-2

Type - Lesson

Term - Ist year

Revised -

TRG AIDS

Computer slides, pointer, black board and marker

TIME PLAN

(a)	Introduction	- 05minutes
(b)	Birth, Growth & expansion of IAF	- 20minutes
(c)	The Indian Air Force Today	- 10minutes
(d)	Conclusion	- 05minutes
	Total	**- 40 Minutes**

INTRODUCTION

1. The Indian Air Force is the youngest the three services. Even though young it has a bright history. The bravery, valour and achievement of the officers and airmen of the IAF are integral part of its proud heritage.

AIM

2. To teach the NCC cadets about the history of Indian Air Force.

PREVIEW

3. The class will be conducted in following parts.

(a) Part I - Birth, Growth and Expansion of IAF

(b) Part II - The Indian Air Force today

BIRTH OF THE IAF

4. The origin of the IAF can be traced to the Indian Sandthurst committee known as a Skeeny committee. This committee was setup by the Govt. of India in 1925 with Sir Andrew Skeen, The Chief of General Staff as its chairman to enquire and recommend the rate at which Indians should be recruited for the grant of commissions in the Armed forces. The report was published on 1st April 1927. The Skeeny committee recommended that steps should be taken t create an Air Arm of the Indian Army and till such time facilities for flying training made available in India, its officers should be trained at Royal Air Force(RAF) college, Cranwell. From 1928 onwards 2 seats were reserved at the RAF College, Carnwell for Indians in 1930, six Indians, selected by the government of India enter the college. They were S.C. Sarkar, Subroto Mukharjee, Bhupinder Singh, Awan, Amarjit singh and J.N.Tandon.

5. The first batch was granted their commission as pilots with the exception of Tandon. He was commissioned in the equipment branch and he became the first equipment officer in Indian Air Force.

6. 22 Airmen were selected on 19 Jan 1932 as a ground staff. They begin their training at Karachi. They were known as hawai sepoys.

7 The Government passed the IAF bill on 4 April 1932. The Indian Air Force came into being with the promulgation of the IAF bill on 8 Oct 1932. The Governor General-in-Council at that time consequently ordered the establishment of Indian Air Force with effect from 8 Oct 1932. The Indian Air force anniversary is celebrated on 8 Oct every year.

8. No.1 Squadron (A Flight) of the IAF was formed at Drigh Road, Karachi. It consists of 4 wapiti aircraft, 6 Officers and 22 airmen then known as hawai sepoys. The six officers included the two ex-chiefs of the Air Force, Air Marshal S Mukharjee and Air Marshal AM Engineer.

9. Two more flights (B&C) were formed and added to No.1 Squadron in 1936 and 1939 respectively. Flight lieutenant S Mukharjee took over the command of No.1 Squadron.

10. When World War II broke out in 1939 the problem was of guarding India's vast coastline across and the IAF took active steps to solve it.

11. Training of volunteer reserves began in November, 1939. Six coastal defense flights (CDF) were formed at Madras, Bombay, Calcutta, Cochin, Karachi and Vishakapatnam with Wapiti and Atlanta aircraft. Towards the end of 1942, these flights were disbanded and the new squadrons were formed.

GROWTH AND EXPANSION

12. In its early years expansion of IAF was rather slow. In Sep, 1939 it consisted of only one squadron with a complement of 16 officers and 144 airmen. During World War II the increasing commitments of the RAF in Europe and the impact of Japanese invasion in south-east Asia accelerated the pace of progress.

13. At the end of March 1941, No.1 Squadron and 3 CDFs gave up their Wapitis which were requisitioned to equip No.2 Squadron raised at Peshawar in the following months and were issued instead with Armstrong Withworth Atlanta transport, used to patrol the Sunder bans Delta area south of Calcutta. No.2 CDF had meanwhile received requisitioned D.H.89 Dragon Rapides for convoy and coastal patrol, while No.5 CDF took on strength a single D.H.86 which it used for convoy and patrol the waters of Cape Comorin and the Malabar Coast. By Oct 1943, the strength rose to 8 full squadrons with 911 officers and 40146 airmen. By the end of war two more squadrons were added to it. The squadrons were equipped with variety of aircrafts, viz., Lysander, Wapiti, Audax, Hurricane, Vengeance and Spitfire.

THE INDIAN AIR FORCE TODAY

14. There are five operational Air commands, The Western Air Command with headquarters in Delhi being the prime such and responsible for Air operations from Kashmir southwards to Rajasthan and including the capital and the Punjab, with an operational group dedicated for Jammu and Kashmir including Ladakh. Central Air Command based at Allahabad, encompasses most of Indo-Gangetic plain while, Eastern Air Command, from Shillong, is responsible for Bengal, Assam, the Eastern states of Arunachal Pradesh, Meghalaya, Mizoram and the other bordering on Tibet, Bangladesh and Burma.

15. South Western Air Command, at Gandhinagar, is responsible for air operations in most of Rajasthan, southwards through Gujarat to Saurashtra and the Kutch area. Southern air command was formed in July 1984 with headquarters at Thiruvananthapuram and has, geographically, the largest territory, from the Deccan plateau area to the southern tip of the peninsula and including the islands territories of Lakshadweep and the Andaman and Nicobar islands.

16. Training command has its headquarters at Bangalore with the majority flying and ground training establishment located in southern India. The Maintenance Command functions in Nagpur in central India.

17. The five operational commands through administrative wings, control some 45 fixed wings squadrons, 20 helicopter units and numerous surface to air missile squadrons, with unit establishments varying from 12 to 18 aircrafts. This represents total aircrafts strength of 1700 including training and support types, manned by some 170000 personnel.

CONCLUSION

18. From the raising of Air Force, It has seen various changes and is marching towards the modernization. Since it is the youngest force it has the responsibility of defending the Air territory of our Country.

19. It is the eye in the sky and has the nature of devastating the enemy of the country. From the organization of the Air force and having a few personnel now it has more than a lakh personnel.

20. The five operational commands through administrative wings, control some 45 fix wings squadrons, 20 helicopter units and numerous surface to air missile squadrons, with unit establishments varying from 12 to 18 aircrafts. This represents total aircrafts strength of 1700 including training and support types, manned by some 170000 personnel.

ORGANISATION OF IAF

Period - GSK-3

Type - Lecture

Term - Ist Year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker

Time Plan

2.	(a) Introduction	-	05 minutes
	(b) Explanation	-	30 minutes
	(d) Conclusion	-	05 minutes
	Total	**-**	**40 Minutes**

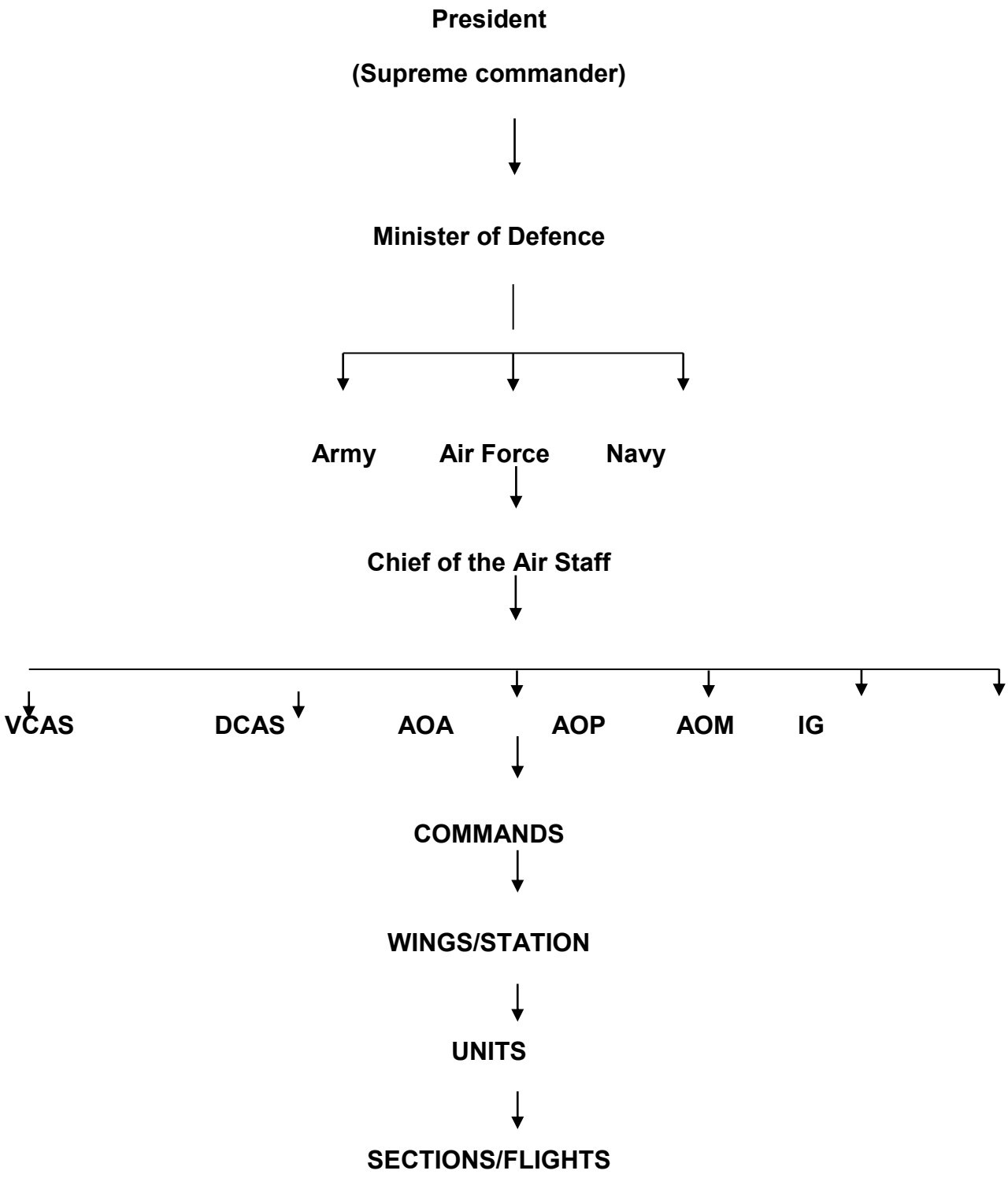
INTRODUCTION

The President is the Supreme Commander of the Armed Forces of Indian Republic. The primary role of the Air Force is the air defence of the country, means Guarding of our air space from enemy intrusion and giving support to the Army and the Navy. Its secondary role is to aid the civil power in maintaining law and order and in providing relief during natural calamities.

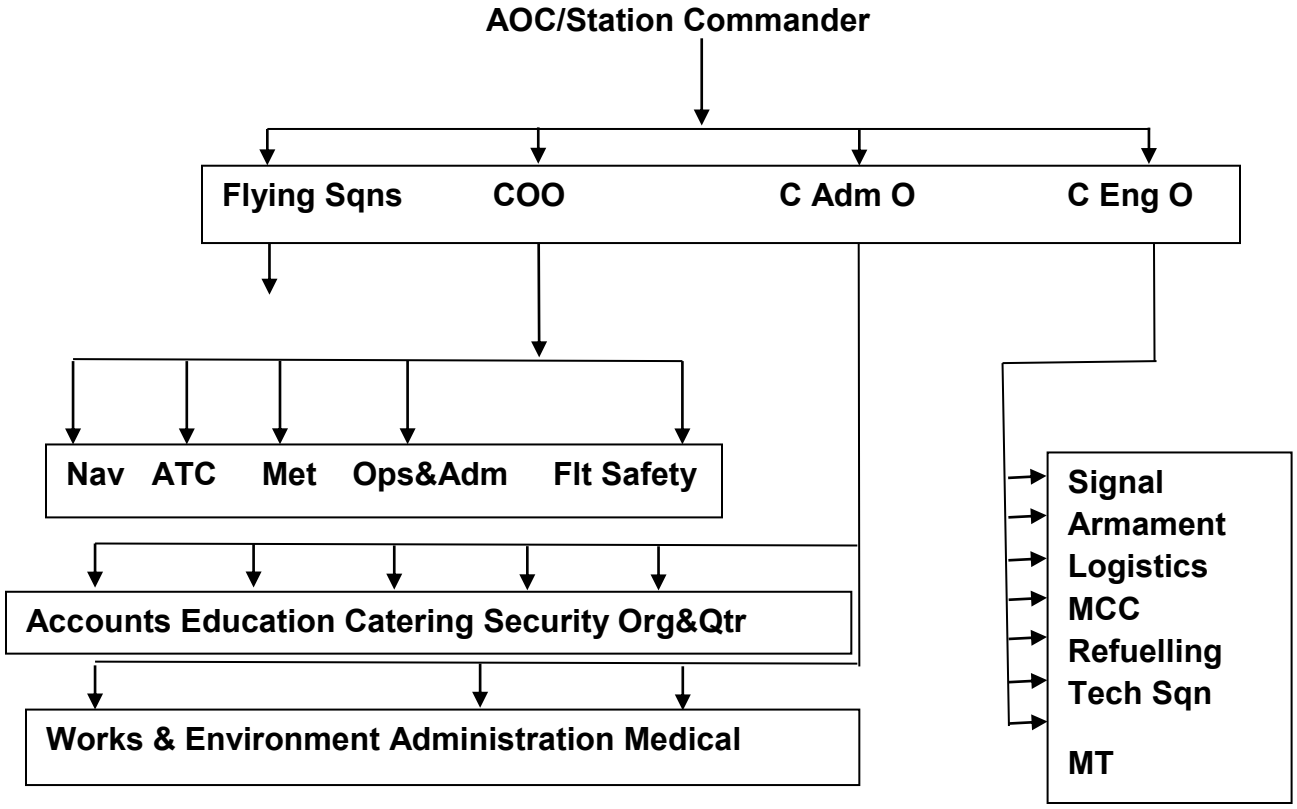
AIM

To teach the NCC cadets about the organization of IAF

EXPLANATION



ORGANIZATION CHART OF A WING/STATION



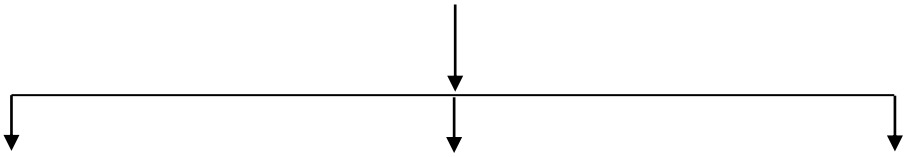
STATION/WING

Station/Wing is always what is called a self accounting unit, i.e it is fully capable and independently responsible for its own administration. A Sqn/lodger units is essentially a non-self accounting unit and it is a lodger to a Wing/Station and depends fully on that Wing/Station for its administration. A Wing/Station exercises its functional and administrative control over its lodger units.

ORGANISATION CHART – OPERATIONAL COMMAND

Air Officer Commanding in Chief

(AOC-in-C)



Senior Air Staff Officer	Senior Officer in Charge Adm	Senior Maint Staff Officer
(SASO)	(SOA)	(SMSO)

Commands

The Western, Central, Easter, South Western, Southern Air Commands control all operational units. Operational Commands execute the operational roles of the Air Force in war. They also handle the training of paratroopers for airborne operating. Training Command is responsible for training of Officers and Airman in all flying and ground training at various academy/training institution/colleges under it. Maintenance Command is responsible for the maintenance, repair and storage of aircraft, MT, Signal equipment, Armament, Ammunition and explosives etc, and exercise functional and administrative control over Base Repair Depot (BRDs) and Equipment Depot (EDs).

Following are the Air Command with their Head Quarters:-

Southern Air Command	---	Trivandrum
Training Command	---	Bangalore
Eastern Air Command	---	Shillong
Maintenance Command	---	Nagpur
Western Air Command	---	New Delhi
South West Air Command	---	Gandhi Nagar
Central Air Command	---	Allahabad

BRANCHES OF IAF

Period - GSK-4

Type - Lecture

Term - Ist Year

Revised By -

Trg Aids

Computer slides, pointer, black board and marker

Time Plan

(a) Introduction	-	05minutes
(b) Explanation	-	30minutes
(d) Conclusion	-	05minutes
Total	**-**	**40 Minutes**

INTRODUCTION

3. For smooth functioning of organization different branches among staff is essential. Vast organization like Indian Air Force requires various branches to make the organization successful and flawless. The responsibility of branches like flying, Medical, Administration and so on has got their respective role. In this lesson we will discuss about branches in IAF.

AIM

4. To teach the NCC cadets about the Branches in IAF

EXPLANATION

Following are the different Branches in the IAF

(a) Flying Branch
(b) Navigation Branch
(c) Education Branch
(d) Medical Branch
(e) Administration Branch
(f) Logistic Branch
(g) Meteorology Branch
(h) Engineering Branch

CONCLUSION

5. In this lesson we learnt about various branches of IAF. The branches among personnel made the organization to function smoothly. The role and responsibilities of the branches in IAF perform their activities selflessly and obediently. Without the co-operation there is no existence of an important defence organization like IAF.

MODES OF ENTRY IN THE IAF

Period - GSK-5

Type - Lecture

Term - Ist Year

Revised By -

Trg Aids

Computer slides, pointer, black board and chalk

Time Plan

(a) Introduction	-	05minutes
(b) Different types of Entry	-	30minutes
(d) Conclusion	-	05minutes
Total	**-**	**40 Minutes**

AIM

To learn about the Modes of Entry in the IAF & Qualification required to enter in the IAF.

EXPLANATION

3. Followings are the essential requirements for entry in the IAF to become Commissioned Officer

Branch/Type of Entry	Educational Qualification	Age Limit	Advertisement Schedule
(A) FLYING BRANCH			
1.National Defence Academy (NDA) For Men only	10+2 With Physics& Math	16 1/2 –19	Mar/Oct
2. Combined Defence Service (CDSE) For Men only	Any Grad. With Physics & Math at 10+2 or BE	19-23	Apr/Sep
3. NCC Special Entry (Through COMMANDING OFFICER unit /DG NCC) For Men only	Any Grad. with Physics & Math at 10+2 or BE&NCC Air Wing Sr Div. “C’ Certificate	19-23	Jun/Dec
4. Short Service Commission (For Women only)	Any Grad. With Physics Maths at10+2 or BE	19-23	Mar/Sep
(B) TECHNICAL BRANCH (PC For Men/ SCC For Women)			
1. Aeronautical Engineering (Electronics) 2. Aeronautical Engineering (Mechanical)	First class degree in Engineering or GATE score of 70% & above in Electronics / Mechanical/ Allied subjects as per advertisement	18-28	Feb/Aug
(C) GROUND DUTY BRANCH (PC For Men / SCC For Women			
1. Administration 2. Logistics 3. Accounts	First Class Graduate or PG in subjects as per advertisement	20-23 20-25	Mar/Sep
4. Education 5. Meteorology	PG in subjects as per advertisement	20-25	Mar/Sep

TO BECOME AN AIRMEN

GROUP	*AGE (As on date of Enrolment)	EDUCATIONAL QUALIFICATION
Group 'X' (Technical) Trades	17 - 22 Years	Passed Intermediate / 10+2 / equivalent examination with Mathematics, Physics and English with a minimum of 50% marks in aggregate. OR Three years Diploma course in Engineering (Mechanical / Electrical / Electronics / Automobile / Computer Science / Instrumentation Technology / Information Technology) with at least 50% marks in overall aggregate from a Government recognised Polytechnic Institute.
Group 'X' (Education Instructor) Trade	20-25 Years	Graduate in Arts, Commerce or Science with B. Ed degree/two years teaching experience in a Government recognised School/College. Candidate should have scored a minimum of 50% marks in aggregate in Graduation as well as B. Ed. **OR**
	20-28 Years	Passed MA English / M Sc in Mathematics, Physics, Computer Science / MCA with B Ed degree /2 Years teaching experience in a Government recognised School / College.
Group 'Y' Trades (Except Med Asst and Musician Trade)	17-22 Years	Passed Intermediate /10+2 / equivalent examination with Science, Arts or Commerce subjects or equivalent vocational course with minimum 50% marks in aggregate. Vocational courses should be recognised by Association of Indian Universities. **OR** Three years Diploma in any stream of Engineering from a Government recognised Polytechnic Institute.
Group 'Y' (Med Asst) Trade	17-22 Years	Passed 10+2 / Intermediate / equivalent exam with Physics, Chemistry, Biology and English with a minimum of 50% marks in aggregate.
Group 'Y' (Musician) Trade	17-25 Years	Passed Matriculation /10th class or equivalent with minimum pass marks from any Government recognised School/Boards and should be proficient in playing at least one of the following musical instrument: Trumpet / Bass / Violin / Saxophone / Clarinet / Euphonium / Jazz-Drum / Piccolo / Bass Trombone / Key Board / Guitar / Sarod / Viola / Cello / Contra Bass (String Bass).

 # Age Date on enrolment

CONCLUSION

During the lecture different types of entry have been discussed for entry in the IAF which including the qualifications and advertisement schedule.

CHAPTER – II

AIR CAMPAIGNS

INDO PAK WAR- 1971

Period - AC-1

Type - Lecture

Term - Ist year

Revised by -

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Trg Aids

1. Computer slides, pointer, white board and marker pen.

Time Plan

2.	(a)	Introduction	-	05 mins
	(b)	Aggression by Pakistan	-	05 mins
	(c)	Aggression Anticipated	-	05 mins
	(d)	Damage Reported (i) Civil Areas (ii) Military airfields and aircraft	-	05 mins
	(e)	Pakistani Soldiers Surrender	-	02 mins
	(f)	Emergency Declaration	-	03 mins
	(g)	Why Indo Pak War?	-	05 mins
	(h)	Recognition of Bangladesh by India	-	05 mins
	(j)	Summary	-	05 mins
		Total	**-**	**40 Mins**

INTRODUCTION

1. India's commitment to peace has always been total and irrevocable. This does not, however, mean submission before force or violence. Gandhiji always made the subtle but significant distinction between non violence and cowardice. Hence, when the Pakistan hordes descended on us on the evening of 3rd December, we were left with no option but to give a fitting reply. This is what precisely our defence forces did. In the process the enemy's war machinery was dealt crippling blows. What is more, our armed forces in conjunction with the Mukti Bahini ended the dark night of oppression and brutality in East Bengal and ushered in the new state of Bangladesh. All this was achieved in a remarkably short period of fourteen days. In fact the unconditional surrender by the enemy's one lakh armed forces is unprecedented.

AGGRESSION BY PAKISTAN

2. Darkness had just fallen on the evening of 3rd December 1971 when air raid alert was sounded at 6 PM in most of the cities in India. With the sounding of siren all lights went off. Everyone including the President, the Cabinet Ministers, the Member of Parliament, the newsmen was taken unaware. The briefing officer told newsmen that the raid alert was a genuine one. Soon people realised the seriousness of the situation. The street lights were never switched ON. The cities were plunged into darkness. The A.I.R then revealed the unfortunate incident of unprovoked aggression by Pakistan.

3. The military junta of Pakistan seemed to have chosen the hour of attack with some deliberation and care. The Prime Minister Smt Indira Gandhi was away from New Delhi on days visit to Calcutta, where she had just finished speaking to a large gathering on the Pakistani threat to India's security and the liberation struggle in the Bangladesh. The Defence Minister, Shri Jagjivan Ram was at Patna. The Finance Minister YE Chavan left the capital minutes before the Pakistani attack was launched.

4. The Pakistani Air Force and ground troops following the Israeli type pre-emptive strike had launched a massive attack on the Western front stretching from Jammu & Kashmir to Rajasthan. Pakistani Radio went on the air alleging an Indian attack, when the Pakistani planes were bombing our air fields in sneak raids. Pakistan's friend, philosopher and guide Peking's New China News Agency also broadcasted similar allegations.

5. In addition to air raids by the Pakistani Air Force the ground forces also launched a massive attack on our border posts.

AGGRESSION ANTICIPATED

6. Although unprovoked aggression came as a surprise to the people in general, and they were taken unaware, the Govt of India is reported to have anticipated it. The aircraft had been removed from those airfields well in advance. In view of, while damage had been caused to runways or otherwise to some airports, Pakistan's basic strategy failed. The intruding Pakistani fighter planes, despite the persisted raids made on various airfields, could not destroy any Indian aircraft. Necessary steps had been taken by Govt to ensure the safety of our aircraft. Indian anti aircraft guns went into action and IAF Gnats chased the Pakistani planes away. In this process three Pakistani planes had been shot down.

DAMAGE REPORTED

7. **Civil Areas**:

(a) In Rajasthan six people were injured, when a Pakistani aircraft dropped two bombs near bus stand.

(b) In Pathankot one person was killed in the Pakistani bombing.

(c) Houses in Gandhinagar were rocked by the unprovoked Pakistani shelling.

8. **Military airfields and aircrafts**

(a) Aircraft and one 3 tonne vehicle had been hit by Pakistani bombs near Amritsar. In Halwara Pakistani planes dropped four time bombs which exploded after the aircraft fled.

PAKISTANI SOLDIERS SURRENDER

9. In Akhaura area 12 soldiers of the Pakistani army and 10 personnel from among Pakistani para military troops surrendered to the Indian army.

EMERGENCY DECLARATION

10. It was felt that a state of emergency be declared in the country in order to combat the aggression. The decision was subsequently endorsed by the full cabinet and within five hours of the Pakistani attack, President VV Giri proclaimed a national emergency at 11 PM under article 353 of the constitution.

WHY INDO-PAK WAR?

11 The main problem was creation of conditions in Bangladesh which would be conducive to the safe and speedy return of 11 million refugees which had crossed our borders from East Bengal. During 1972, the cost of feeding refugees would amount to £290 million as against the international aid of about £190 million. On 5th December 1971, Sunday Times, London reported "one result of India's victory would be the collapse of military rule and the triumph of democracy. It is no paradox therefore, to see that India is fighting to bring freedom to all the people of the sub-continent, who are in the eye of God, one people".

RECOGNITION OF BANGLA DESH BY INDIA

12. The East Pakistan Rifles and East Bengal Regiment became the Mukti Fouj and later the Mukti Bahini which was joined by thousands of young East Bengal's determined to sacrifice their lives for freedom. Government of Bengla Desh and Government of India unanimously decided to grant recognition to the 'Gana Prajatantra Bangladesh'. The father of the new state became Sheikh Mujibur Rehman, Dhaka became the capital.

SUMMARY

13 In fact the suppression by military junta of Pakistan carried on in Bangladesh and the exemplary courage displayed by the people of Bangladesh in facing such situation is not a secret. It has been recorded in the world press. No one can say that India's decision to recognise Bangladesh is based on emotions and not based on present and future realities. It can also not be said to be a hasty step for recognition was accorded only after Pakistan was unable to exercise any control over the people of Bangladesh. "The will of the nation substantially expressed". The act of according of recognition to Bangladesh is to admit realities, and since history has such precedence, when an emerging colony was accorded independence, recognition Bangladesh, which has been treated as a colony and which was emerged successfully from its parent country, cannot be condemned by any nation. Later on National flag and National song sung by free country Bangladesh 'Amar Sonar Banglatomai ami bhalobasi'.

OPERATION SAFED SAGAR

Period - AC -2

Type - Lecture

Term - Ist year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker

Time Plan

2. (a) Introduction - 05 minutes

(b) Operation Details - 30 minutes

(d) Conclusion - 05 minutes

Total - 40 minutes

INTRODUCTION

1. Operation Safed Sagar was the codename assigned to the Indian Air Force's strike to support the Ground troops during Operation Vijay that was aimed to flush out Regular and Irregular troops of the Pakistani Army from vacated Indian Positions in the Kargil sector along the Line of Control. It was the first large scale use of air power in the Jammu and Kashmir region since the Indo-Pakistani War of 1971.

AIM

2. To teach the NCC cadets about the how our country has protected our sovereignty and use military power against infiltration using Air Power.

Ground operations

3. Initial infiltrations were noticed in Kargil in early May, 1999. Because of the extreme winter weather in Kashmir, it was common practice for the Indian and Pakistan Army to abandon forward posts and reoccupy them in the spring. That particular spring, the Pakistan Army reoccupied the forward posts before the scheduled time not only theirs but also which belonged to India, in a bid to capture Kashmir.

4. By the second week of May, an ambush on an Indian army patrol acting on a tip-off by a local shepherd in the Batalik sector led to the exposure of the infiltration. Initially

with little knowledge of the nature or extent of the encroachment, the Indian troops in the area initially claimed that they would evict them within a few days. However, soon reports of infiltration elsewhere along the LoC made it clear that the entire plan of attack was on a much bigger scale. India responded with Operation Vijay, a mobilization of 200,000 Indian troops. However, because of the nature of the terrain, division and corps operations could not be mounted; the scale of most fighting was at the regimental or battalion level. In effect, two divisions of the Indian Army numbering 20,000, along with several thousand from the Paramilitary forces of India and the air force were deployed in the conflict zone. the Indian Army moved into the region in full force. Soon, the intruders were found to be well entrenched and while artillery attacks had produced results in certain areas, more remote ones needed the help of the air force.

Air operations

5. The Indian Air Force (IAF) was first approached to provide air support on 11 May with the use of helicopters. On 21 May a Canberra on a reconnaissance mission was hit by ground fire. The flight was however, recovered safely, and returned to base on one engine. On 25 May, the Cabinet Committee on Security authorized the IAF to mount attacks on the infiltrators without crossing the LoC. Initial indications from the government to the IAF was to operate only Attack helicopters. However, the Chief of Air Staff put forth the argument that in order to create a suitable environment for the helicopters, fighter action was required. On 26 May, the go-ahead was given and the IAF started its strike role . Flying from the Indian airfields of Srinagar, Avantipur and Adampur, ground attack aircraft MiG-21s, MiG-23s, MiG-27s, Jaguars and the Mirage 2000 struck insurgent positions.

6. The first strikes were launched on the 26 May, when the Indian Air Force struck infiltrator positions with fighter aircraft and helicopter gunships. The initial strikes saw MiG-27s carrying out offensive sorties, with MiG-21s and (later) MiG-29s providing fighter cover. Mil Mi-17 gunships were also deployed in the Tololing sector. Srinagar Airport was at this time closed to civilian air-traffic and dedicated to the Indian Air Force.

7. However, on 27 May, the first fatalities were suffered when a MiG-21 and a MiG-27 jets were shot down over Batalik Sector by Pakistan Army. The following day, a Mi-17 was lost- with the loss of all four of the crew- when it was hit by three Stinger missiles while on an offensive sortie. These losses forced the Indian Air Force to reassess its strategy. The helicopters were immediately withdrawn from offensive roles as a measure against the man-portable missiles in possession of the infiltrators.

8. On 30 May, the Indian Air Force called into operation the Mirage 2000 which was deemed the best aircraft capable of optimum performance under the conditions of high-altitude seen in the zone of conflict. Armed initially with 250 kg "dumb" bombs, No.7 Squadron over three days, struck infiltrator positions in Muntho Dhalo, Tiger Hill and Point 4388 in the Drass Sector. The strikes on Muntho Dhalo on 17 June also destroyed logistics and re-supply capabilities of the infiltrators in the Batalik Sector. Through the

last weeks of June, the Mirages, armed with LGBs as well as with "dumbs", repeatedly struck the heavily defended Tiger Hill.

9. The choppers used were Mi-8 and the Mi-17. The transport planes were Avro, An-32 and IL-76. On May 27, the IAF had sent a MiG-27 on a photo reconnaissance mission over the Indian side of the Line of Control in Kashmir Pilot ejected from MiG-27 after an engine flameout due to Pakistani retaliation.

10. The next day the Air Force lost an Mi-17 Helicopter to a shoulder fired missile near Tololing, killing the crew of four. This resulted in a change in strategy and technology. With the Israelis providing around 100 Laser-guided bomb kits to the Indian Military, the air force chose to make maximum use of this and retaliated with regular sorties on Pakistani occupied bunkers. The aircraft operated at 10,000 meters AGL (33,000 feet above sea level), well out of MANPADs range, leading to a drop in the accuracy rate of the bombs. The low number of airstrips for take off and landing of the flights also constrained the efficiency of the attacks. Despite this, there were hundreds of sorties on the intruders with no further material or personnel casualties enabling a gradual takeover of the mountain posts by Indian troops. According to IAF the "air strikes against the Pakistani infiltrators, supply camps and other targets yielded rich dividends."

11. By July all the remaining intruders had withdrawn and the operation was ended, being declared a success by the IAF in having achieved its primary objectives. However there has also been criticism of the methods initially used and the type of planes being unsuitable to the terrain that resulted in early losses. This is believed by many in the air force as coming as a wakeup call to upgrade the aging fleet of craft (especially the attack aircraft and helicopters) to better enable them to fight in the mountainous region. But, in the context of the war and in light of the poor information available on the infiltrations, the Indian Air Force was able to coordinate well with the Army and provide air support to the recapture of most the posts before Pakistan decided to withdraw its remaining troops.

Conclusion

12. Operation Safed Sagar, as the air operation in the Kargil area was called, was indeed a milestone in the history of military aviation. This was the first time that air power was employed in such an environment. Fighters as well as armed helicopters carried out many hundreds of sorties against the armed intruders who had infiltrated into the Indian Territory. The use of air power in this theatre was instrumental in accelerating the end of the conflict to India’s advantage. IAF’s air strikes against enemy supply camps and other targets yielded rich dividends. A noteworthy fact is that there was not a single operation on ground that was not preceded by air strikes, each and every action was a result of coordinated planning. The enemy was kept off the backs of the Indian Army. In the area of interdiction of enemy supplies, the successful and incessant attacks on the enemy’s logistic machines, over the weeks, culminated in a serious degradation of the enemy’s ability to sustain them.

MOTIVATIONAL MOVIES

Period - AC-3

Type - Movie

Term - Ist year

Revised By -

Trg Aids

1. Computer , Projector and speakers

Time Plan

2. (a) Introduction - 05 minutes

(b) Branches of IAF - 05 minutes

(c) Join IAF - 25 minutes

(d) Conclusion - 05 minutes

CHAPTER – III

AIRCRAFT RECOGNITION

HELICOPTERS
(ACR-1)

Period - ACR-1

Type - Lecture

Term - IInd year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker

Time Plan

2.	(a) Introduction	-	05minutes
	(b) Identification	-	05minutes
	(c) Salient features	-	25minutes
	(d) Conclusion	-	05minutes
	Total	**-**	**40 Minutes**

INTRODUCTION

1. Aircraft Recognition is essential to identify the aircraft during both in peace and war.

Identification of Helicopters

2. DURING PEACE TIME: Aircraft recognition helps to identify the different types of aircraft possessed by the enemy and assess the strength of the country and prepare for own self defense.

3. DURING WAR TIME: Aircraft recognition helps the MOP (mobile observation post) to identify while Aircraft is friend or foe. It also helps to know the capability of the aircraft by identifying its type.

SALIENT FEATURES - HELICOPTERS

Chetak (Alouette-III)

Role: General Purpose Light Transport.

Particulars:

Length/ Height--	10.03 /3.09 Metres
Max Take-Off Weight--	2100 Kgs
Fuel Capacity--	575 Litres
Pay Load--	05 Passengers

Performance:

Cruise/Max Speed--	190/210 KMPH
Range--	500 Km
Engine (Power)--	Single Turbo shaft(586 HP)

Special Features

- French design, built under licence by HAL.
- It's other version, Cheetah is lighter by 150 Kg, thus suitable for operations at high altitudes of Leh, Ladakh and Siachen Glacier.

MI-8

Role: Medium Range Lift Helicopter.

Particulars:

Length/Height--	25.24 / 5.65 Metres
Fuel Capacity--	2960 Litres
Pay Load--	24 Combat Troops

Special Features

- It has tail rotor on starboard side of vertical stabiliser.

MI-17

Role: Medium Range Lift Helicopter.

Particulars:

Length/Height--	18.2 / 5.65 Metres
Max Take-Off Weight--	13000 Kgs
Fuel Capacity--	3680 Litres
Pay Load--	3300 Kgs (24 Combat Troops)

Performance:

Cruise/Max Speed--	240/256 KMPH
Range--	950 Km
Engine (Thrust)--	Two Turbo shafts(1900 hp each)

Special Features

- It is an upgraded version of MI-8, with better engine power. It has tail rotor on port side of vertical stabiliser.
- It can carry six pods of 57 mm rockets.

CONCLUSION

The individual has to learn to recognize aircraft. In this lesson we have learnt about how to recognize various helicopter of IAF. Many factors are involved in making an identification of an aircraft and the distance at which it can be positively identified. Some of these are size, viewing angle, visibility, aircraft finish, visual characteristics, colour and external markings

TRANSPORTS

(ACR-2)

Period - ACR-2

Type - Lecture

Term - IInd year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker

Time Plan

2.	(a) Introduction	-	05minutes
	(b) Identification	-	05minutes
	(c) Salient features	-	25minutes
	(d) Conclusion	-	05minutes
	Total	**-**	**40 Minutes**

INTRODUCTION

1. Aircraft Recognition is essential to identify the aircraft during both in peace and war.

Identification of Transport Aircrafts

2. DURING PEACE TIME: Aircraft recognition helps to identify the different types of aircraft possessed by the enemy and assess the strength of the country and prepare for own self defense.

3. DURING WAR TIME: Aircraft recognition helps the MOP (mobile observation post) to identify while Aircraft is friend or foe. It also helps to know the capability of the aircraft by identifying its type.

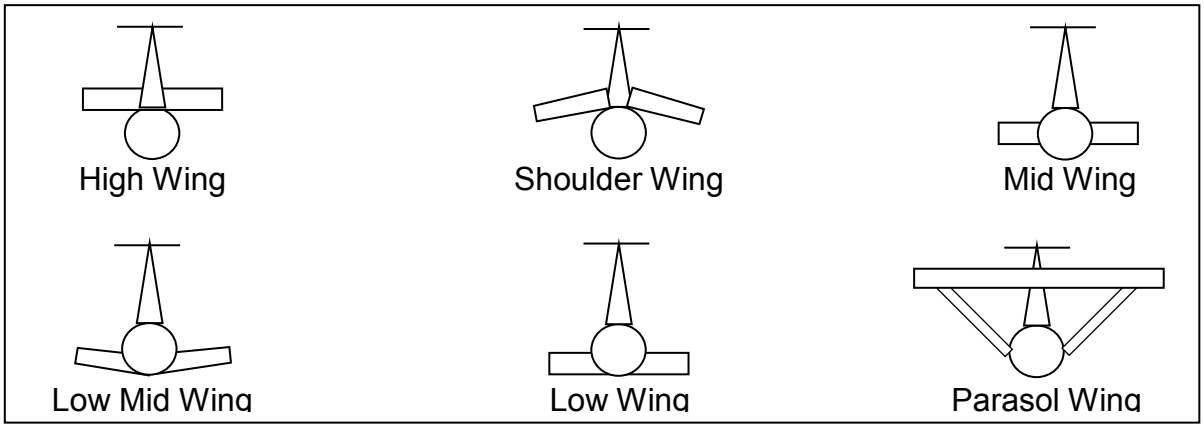
EXPLANATION

There are various methods used to identify the aircrafts:

(a) Wing position (b) Wing shape (c) Shape of wing tips
(d) Shape of canopy (e) Shape of fins and tail plane (f) Markings

(a) Recognition by the wing position:

(i) High wing (ii) Shoulder wing (iii) Mid wing
(iv) Low mid wing (v) Low wing (vi) Parasol wing



(b) Wing shape:

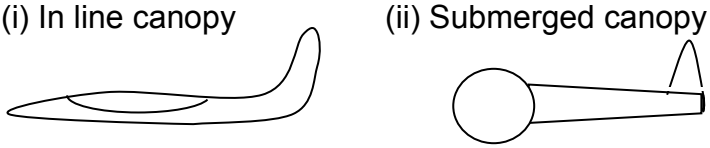
(i) Rectangular (ii) Elliptical (iii) Forward taper
(iv) Backward taper (v) Equitaper (vi) Delta
(vii) Crescent (viii) Swept back (ix) Swept forward
(x) Bi-plane (xi) Mono plane (xii) Dihedral
(xiii) Anhedral

(c) Shape of wing tip:

(i) Circular (ii) Taper (iii) Pointed (iv) Square

(d) Shape of canopy:

(i) In line canopy (ii) Submerged canopy (iii) Tear drop canopy

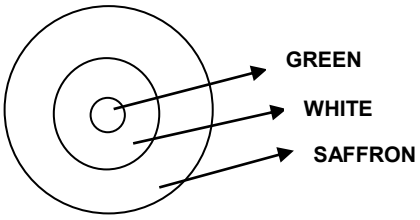


(v) Glass house canopy (iv) Bubble canopy

(d) Shape of fin and tail plane:

(i) High tail plane (ii) High mid tail plane (iii) Mid tail plane
(iv) Low mid tail plane (v) Low tail plane

(f) Markings:
(a) Indian Air Force



On fuselage & below wing

SAFFRON	WHITE	GREEN

SALIENT FEATURES - TRANSPORT AIRCRAFTS

DORNIER-228

Role: Utility/Commuter Aircraft.

Particulars:

Length/Span/Height--	16.56 / 16.97/ 4.86 Metres
Max Take-Off Weight--	5980 Kgs
Fuel Capacity--	2380 Litres
Pay Load--	1900 Kgs (upto 19 passengers)

Performance:

Cruise/Max Speed--	428 Kmph
Range--	2700 Km
Engine (Power)--	Two Turbo-props (715 HP each)

Special Features

- For maritime role, it is fitted with high-resolution radar with a scanning range of 475 Km with a capacity of track 32 targets.
- Two under-wing pods for carrying guns for spraying oil binding pollutants in pollution-prevention role.

AVRO (HS-748)

Role: Medium Lift Transport.

Particulars:

Length/Span/Height--	20.42 / 30.02/ 7.57 Metres
Max Take-Off Weight--	21000 Kgs
Fuel Capacity--	6550 Litres
Pay Load--	5220 Kgs

Performance:

Cruise Speed--	452 Kmph
Range--	1482 Km
Engine (Power)--	Two Turbo-props (2280 hp each)

Special Features

- British Aerospace Design, first produced by HAL, Kanpur Division under licence in 1964.
- Used by the IAF, BSF and other agencies in a variety of roles like VIP duties, navigator/signaller training and para-dropping.

AN - 32

Role: Short/Medium Lift Transport.

Particulars:

Length/Span/Height--	23.8 / 29.2/ 8.6 Metres
Max Take-Off Weight--	26000 Kgs
Fuel Capacity--	7000 Litres
Pay Load--	6700 Kgs (upto 39 para-troopers)

Performance:

Cruise Speed--	530 Kmph
Range--	2500 Km
Engine (Power)--	Two Turbo-props (5170 hp each)

Special Features

- It is able to operate from high altitude airfields such as Leh.

CONCLUSION

The individual has to learn to recognize aircraft. In this lesson we have learnt about how to recognize the various transport aircrafts of IAF. Many factors are involved in making an identification of an aircraft and the distance at which it can be positively identified. Some of these are size, viewing angle, visibility, aircraft finish, visual characteristics, colour and external markings

FIGHTERS

(ACR-3)

Period - ACR-3

Type - Lecture

Term - IInd year

Revised By -

Trg Aids

1. Computer slides, pointer, black board and marker.

Time Plan

2.	(a) Introduction	-	05minutes
	(b) Identification	-	05minutes
	(c) Salient features	-	25minutes
	(d) Conclusion	-	05minutes
.	**Total**	**-**	**40 Minutes**

INTRODUCTION

1. Aircraft Recognition is essential to identify the aircraft during both in peace and war.

IDENTIFICATION OF FIGHTER AIRCRAFTS

1. DURING PEACE TIME: Aircraft recognition helps to identify the different types of aircraft possessed by the enemy and assess the strength of the country and prepare for own self defense.

2. DURING WAR TIME: Aircraft recognition helps the MOP (mobile observation post) to identify while Aircraft is friend or foe. It also helps to know the capability of the aircraft by identifying its type.

EXPLANATION

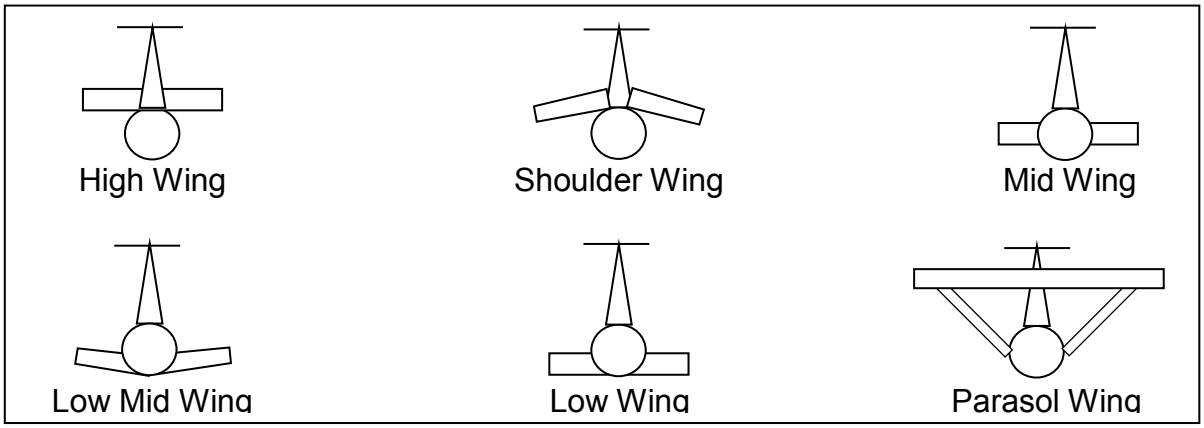
There are various methods used to identify the aircrafts:

(a) Wing position (b) Wing shape (c) Shape of wing tips

(d) Shape of canopy (e) Shape of fins and tail plane (f) Markings

(a) Recognition by the wing position:

(i) High wing (ii) Shoulder wing (iii) Mid wing
(iv) Low mid wing (v) Low wing (vi) Parasol wing



(b) Wing shape:

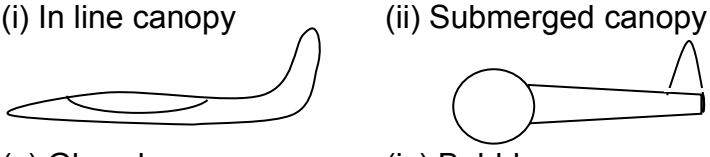
(i) Rectangular (ii) Elliptical (iii) Forward taper
(iv) Backward taper (v) Equitaper (vi) Delta
(vii) Crescent (viii) Swept back (ix) Swept forward
(x) Bi-plane (xi) Mono plane (xii) Dihedral
(xiii) Anhedral

(c) Shape of wing tip:

(i) Circular (ii) Taper (iii) Pointed (iv) Square

(d) Shape of canopy:

(i) In line canopy (ii) Submerged canopy (iii) Tear drop canopy

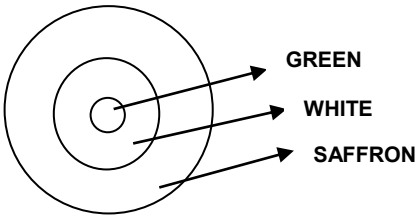


(v) Glass house canopy (iv) Bubble canopy

(d) Shape of fin and tail plane:

(i) High tail plane (ii) High mid tail plane (iii) Mid tail plane
(iv) Low mid tail plane (v) Low tail plane

(f) Markings:
(a) Indian Air Force



On fuselage & below wing

SAFFRON	WHITE	GREEN

SALIENT FEATURES - FIGHTER AIRCRAFTS

KIRAN (HJT-16)

Role: Basic Jet and Armament Trainer

Particulars:

Length/Span/Height--	10.6 / 10.7 / 2.67 Metres
Max Take-Off Weight--	5000 Kgs
Fuel Capacity--	1345+4X255 Litres (Drop Tanks)
Pay Load--	2X250 Kg Bombs (or Rocket Pods) plus 2X7.62 mm Guns

Performance:

Cruise/Max Speed--	600/715 KMPH
Range--	1075 Km
Engine (Thrust)--	Single Turbojet(1900 Kg)

Special Features

- Indigenous design of HAL.MK-II has high powered engine and four (instead of two) hard points for weapons.
- Still in use with the IAF.

MIG- 21 BIS

Role: Single Seater Air Combat/Ground Attack.

Particulars:

Length/Span/Height--	15.0 / 7.15/ 4.13 Metres
Max Take-Off Weight--	10,470 Kgs
Fuel Capacity--	2,885 + 1,780 Litres(Drop Tanks)
Pay Load--	2,020 Kgs including four close combat missiles plus 23 mm twin barrel gun.

Performance:

Cruise / Max Speed--	1,480/2,175 Kmph
Range--	1900 Km
Engine (Thrust)--	Single Turbojet (7500 Kg)

Special Features

- Five hard-points(Four under wings and one under fuselage)
- 125 aircraft shall undergo up gradation at HAL as a result of Rs.1100 crore agreement with Russian design Bureau ANPK-MIG.

CONCLUSION

The individual has to learn to recognize aircraft. In this lesson we have learnt about how to recognize the various fighter aircrafts of IAF. Many factors are involved in making an identification of an aircraft and the distance at which it can be positively identified. Some of these are size, viewing angle, visibility, aircraft finish, visual characteristics, colour and external markings

CHAPTER – IV

PRINCIPLES OF FLIGHT

INTRODUCTION

Period -- PF-1

Type -- Lecture

Term -- I/I

Revised by --

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Stalling	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"When once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return." - Leonardo da Vinci

INTRODUCTION (Slide 01)

1. It is essential to have a basic knowledge of elementary mechanics to understand the various Principles of Flight, because both the aircraft and the atmosphere in which it files are Matters and all matter are subjected to the laws of mechanics. Terms like Mass, Density, Motion, Speed, Velocity, Acceleration, Newton's First Law of Motion, Momentum, Force, Pressure, Newton's Third Law of Motion, Weight, Work, Power, Energy, Law of Conversation of Energy, Moment of a Force, Couple, and Equilibrium.

AIM (Slide 02)

4. To teach Flying Cadets about elementary mechanics required to understand aerodynamics.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

(a) Mass

(b) Density

(c) Speed

(d) Velocity

(e) Acceleration

(f) Newton's First Law of Motion

(g) Momentum

(h) Force

(j) Pressure

(k) Newton's Second Law of Motion

(l) Newton's Third Law of Motion

(m) Weight

(n) Work

(o) Power

(p) Energy

(m) Law of Conversation of Energy

(n) Momentum of a Force

(o) Couple

(p) Equilibrium

(q) Centre of Gravity (CG)

(r) Kinetic Enenrgy

LAWS OF MOTION (Slide 04)

6. **Mass**: Unit - Kilogram (kg) - 'The quantity of matter in a body.' The mass of a body is a measure of how difficult it is to start or stop, ("a body", in this context, means a substance. Any substance a gas, a liquid or a solid).

7. **Density**: It is the mass per unit volume.

8. **Motion**: Motion is said to be there when a body changes its position in relation to its surroundings.

9. **Speed**: Speed is the rate of change of position.

10. **Velocity**: Velocity is speed in particular direction. Velocity is a vector quantity having both magnitude and direction.

11. **Acceleration**: Acceleration is the rate of change of velocity. The change may be in magnitude or direction or in both. Thus a body moving along a circular path at constant speed has acceleration.

$$\text{Acceleration} = \frac{\text{Force}}{\text{Mass}}$$

12. **Newton's First Law of Motion**: A body will continue to be in state of rest or of uniform motion in a straight line unless acted upon by an external force. This property of all bodies is called inertia and a body in such a state is said to be in Equilibrium.

13. **Momentum**: Unit - Mass x Velocity (kg-m/s) - 'The quantity of motion possessed by a body'. The tendency of a body to continue in motion after being placed in motion.

.14. **Force**: Unit - Newton (N) -'A push or a pull'. Thatwhich causes or tends to cause a change in motion of a body.

15. **Pressure**: Pressure is force per unit area.

16. **Newton's Second Law of Motion**: The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the application of the said force.

17. **Newton's Third Law of Motion**: To every action, there is an equal and opposite reaction.

18.**Weight**: (a) The earth exerts a certain force towards its centre on all objects on

its surface. This force is called Weight of the body and is equal to the mass of the body multiplied by the acceleration due to gravity 'g'.Unit - Newton (N) - 'The force due to gravity'. (F = m x g)

19. **Work**: Unit - Joule (J) - A force is said to do work on a body when it moves the body in the direction in which the force is acting. The amount of work done on a body is the product of the force applied to the body and the distance moved by that force in the direction in which it is acting. If a force is exerted and no movement takes place, no work has been done.

e.g. (a) Work = Force x Distance (through which the force is applied)

.20. **Power**: Unit - Watt (W) - Power is simply the rate of doing work, (the time taken to do work)

e.g. (a) **Power (W) =** $\dfrac{\textbf{Force (N) x Distance (m)}}{\textbf{Time (s)}}$

21. **Energy**: Unit - Joule (J) - Mass has energy if it has the ability to do work. The amount of energy a body possesses is measured by the amount of work it can do. The unit of energy will therefore be the same as those of work, joules.

.22. **Law of Conversation of Energy**: The sum total of all energy in the universe remains constant.

23. **Momentum of a Force**: Moment of a force is the turning effect of the force about a point and is measured as the product of the force and the perpendicular distance between the point and the line of action o the force.

24. **Couple**: A couple consists of two equal and opposite and parallel forces not acting through the same point. The moment of a couple is equal to the force multiplied by the perpendicular distance between the two lines of action.

25. **Equilibrium**: A body is said to be in equilibrium when

(i) Algebric sum of all the forces acting on the body is zero.
(ii) Clockwise moment is equal to the anticlock wise moment about any point.

26. **Centre of Gravity (CG):** The point through which the weight of an aircraft acts.

(a) An aircraft in flight is said to rotate around its CG.

(b) The CG of an aircraft must remain within certain forward and aft limits, for reasons of both stability and control

27. **Kinetic Energy:** Unit - Joule (J) - 'The energy possessed by mass because of its motion'. 'A mass that is moving can do work in coming to rest'.

$$KE = {}^{1}/2\ m\ V^2 \text{ joules}$$

CONCLUSION

28. A flying object is a mechanical body in a three dimensional space. The knowledge of above definitions is necessary for effective understating of Principle of Flight.

PRINCIPLE OF FLIGHT - GLOSSARY OF TERMS

Period -- PF-2

Type -- Lecture

Term -- I/II

Revised by --

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Stalling	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"Do not let yourself be forced into doing anything before you are ready."- Wilbur Wright

INTRO (Slide 01)

3. The following are the Main Glossary of Terms which required for understanding, Principle of Flight. Like Aerofoil, Chord line, Chord length, angle of attack, angle of incidence, total reaction, lift, drag, Thrust and weight.

AIM (Slide 02)

5. To teach Flying Cadets about different Glossary of Terms used in aerodynamics.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

(a) Aerofoil

(b) Chord line

(c) Chord length

(d) Angle of Attack

(e) Angle of Incidence

(f) Total Reaction

(g) Lift

(h) Drag

(j) Thrust

(k) Weight

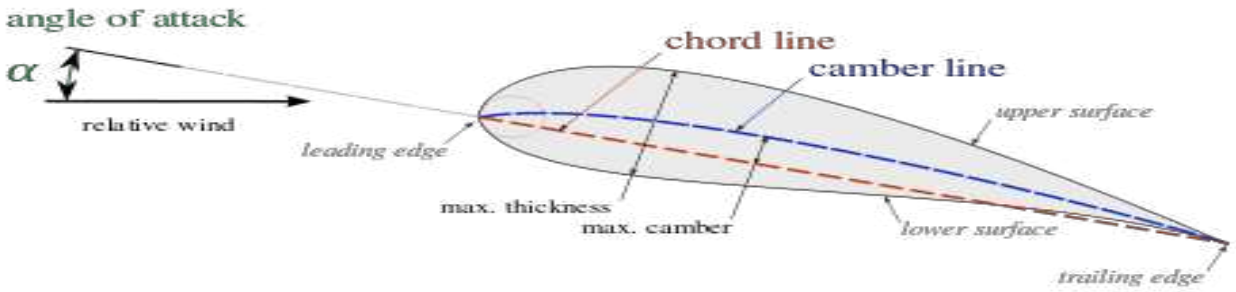
GLOSSARY OF TERMS (Slide 04)

6. **Aerofoil:** A body designed to produce more lift than drag. A typical aerofoil section is cambered on top surface and is more or less straight at bottom.

7. **Chord line**: It is a line joining the centres of curvature of leading and trailing edges of an aerofoil section.

8. **Chord length**: It is the length of chord line intercepted between the leading and trailing edges.

9. **Angle of attack:** It is the angle between the chord line and the relative air flow undisturbed by the presence of aerofoil.



10. **Angle of incidence**: The angle between the chord line and the longitudinal axis of the aircraft.

11. **Total Reaction:** It is one single force representing all the pressures (force per unit area) over the surface of the aerofoil. It acts through the centre of pressure which is situated on the chord line.

12. **Lift:** The vertical component of Total Reaction, resolved at right angles to the relative airflow.

13. **Drag:** The horizontal component of the Total Reaction acting angles and in the same direction as the relative airflow.

CONCLUSION

14. The Flying cadets should have thorough understanding of the above definitions for better understanding of Principle of Flight and aerodynamics of flying objects.

FORCES ACTING ON AIRCRAFT

Period -- PF-3

Type -- Lecture

Term -- I/III

Revised by --

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Stalling	-	30 mins
	(c)	Conclusion	-	05 mins
	Total		**-**	**40 Mins**

"*It is possible to fly without motors, but not without knowledge and skill."*-

Wilbur Wright

INTRO DUCTION (Slide 01)

3. An Aircraft is considered to be in straight and level flight when it is flying at a constant altitude and speed, maintaining lateral level and direction. Force acting on aircraft and any given movement are Lift, Drag, Thrust and Weight.

AIM (Slide 02)

4. To teach the flying Cadets about forces acting on aircraft.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

(a) Lift (b) Drag (c) Thrust (d) Weight

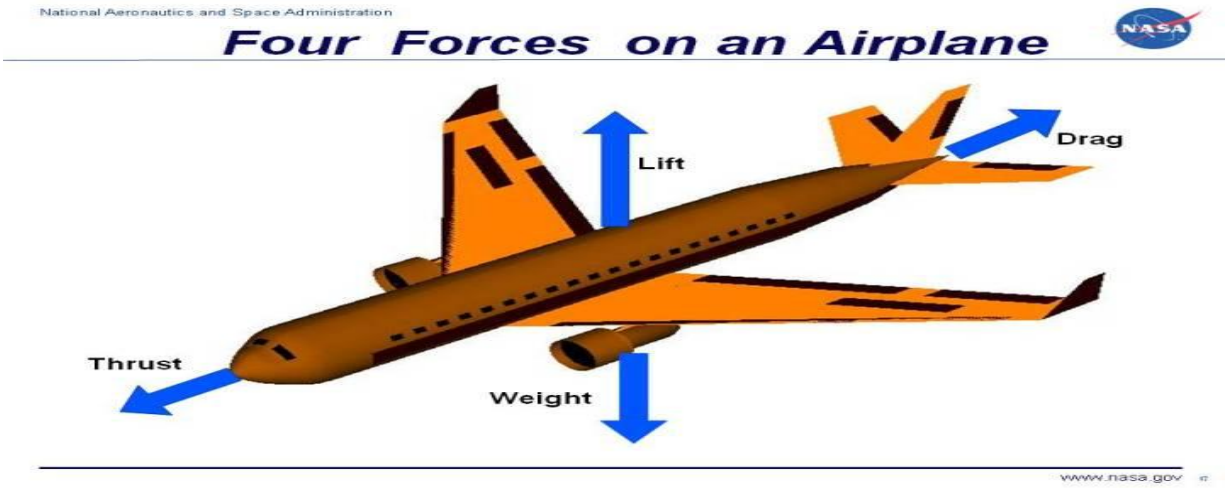
FORCES ACTING ON AIRCRAFT (Slide 04)

6. **Lift** is a positive force caused by the difference in air pressure under and above a wing. The higher air pressure beneath a wing creates lift, and is affected by the shape of the wing. Changing a wing's angle of attack affects the speed of the air flowing over the wing and the amount of lift that the wing creates.

7. **Weight**is the force that causes objects to fall downwards. In flight, the force of weight is countered by the forces of lift and thrust.

8. **Thrust** is the force that propels an object forward. An engine spinning a propeller or a jet engine expelling hot air out the tailpipe are examples of thrust. In bats, thrust is created by muscles making the wings flap.

9. **Drag** is the resistance of the air to anything moving through it. Different wing shapes greatly affect drag. Air divides smoothly around a wing's rounded leading edge, and flows neatly off its tapered trailing edge...this is called streamlining.



CONCLUSION -

10. The flying cadets should thoroughly understanding the above basic concepts of level flight for better understanding of aerodynamics.

CHAPTER – V

PARTS OF AN AIRCRAFT

PARTS OF AN AIRCRAFT

Period -- PA-1

Type -- Lecture

Term -- I/II

Revised by --

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Parts of an aircraft	-	30 mins
	(c)	Conclusion	-	05 mins
	Total		**-**	**40 Mins**

INTRO DUCTION (Slide 01)

3. Fuselage is the main body of the aircraft to which all the other components like wings, ailerons, rudders, elevators and undercarriage are attached. It also contains the cockpit from where the pilot controls the aero-plane. It provides the space for the freight and passengers.

AIM (Slide 02)

4. To teach about the parts of an aircraft.

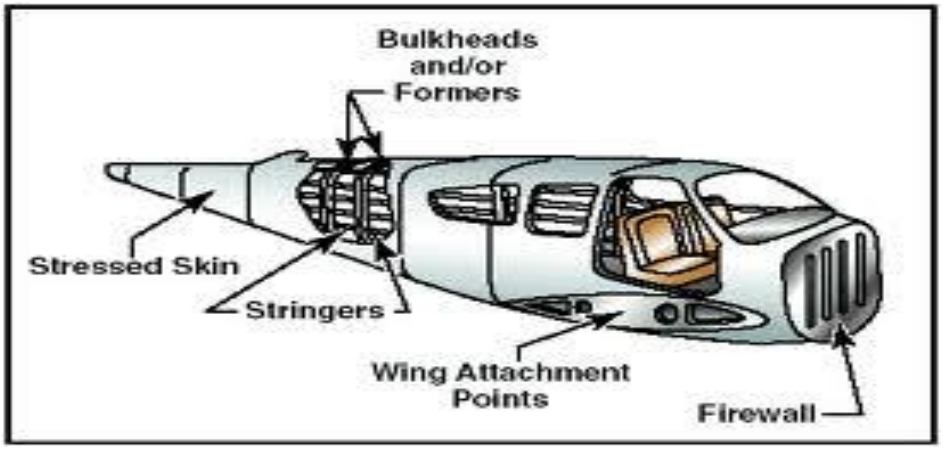
BASIC DESIGN OF A FUSELAGE (Slide 03)

5. The basic design of fuselage should satisfy the following:

(a) Smooth skin of the required aerodynamic form.
(b) Sufficient strength to withstand aerodynamic loads.
(c) Sufficient stiffness to retain its correct shape under all loads.
(d) Mounting points for engine, armament, fuel tanks and equipment.

(e) Protection of aircrew and passengers from ambient conditions.

6. A basic fuselage layout is shown below for easy understanding. As can be seen, it comprises fire wall, wing attachment points, landing gear attachment points, stringers, bulk head/formers and stressed skin.



MATERIALS USED

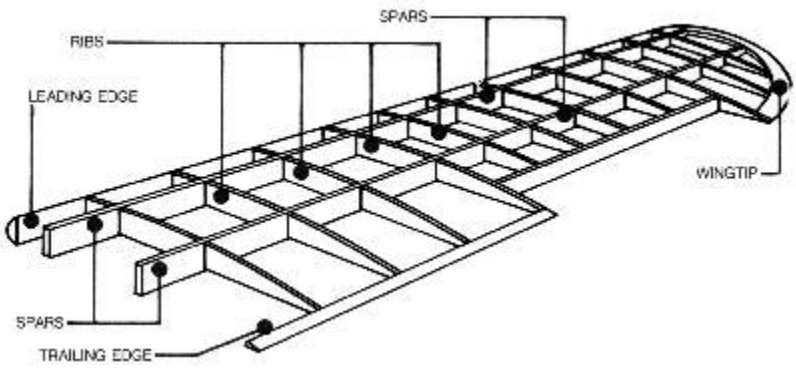
7. The various types of materials can be classified as follows:

(a) Wood
(b) Metals
(c) Composites

MAIN PLANE AND TAIL PLANE

8. Main plane and Tail plane play a major role in ensuring effective control of aircraft during its flight.

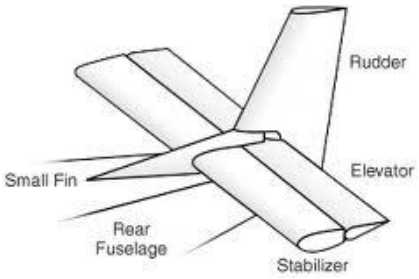
MAIN PLANE



9. There are various types of wings as shown in figure below. They are as follows:

(a) Straight wing
(b) Swept back wing
(c) Delta wing
(d) Tapered wing
(e) Variable geometry wing

TAIL PLANE



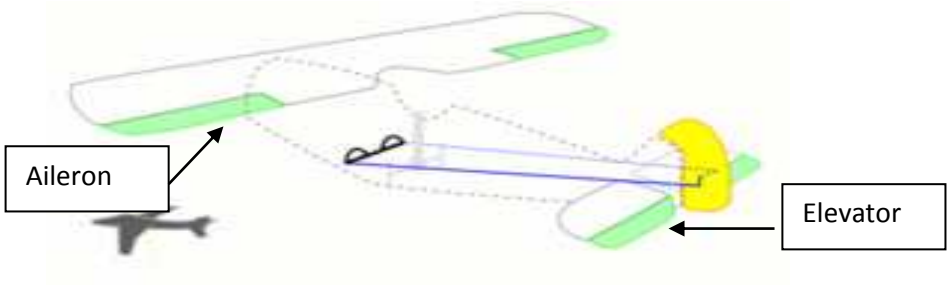
10. As shown in figure above, a tail plane, also known as horizontal stabilizer is a small lifting surface located on the tail behind the main lifting surfaces of a fixed-wing aircraft as well as other non-fixed wing aircraft such as helicopters**.** The tail plane serves three purposes: equilibrium, stability and control.

AILERON AND ELEVATORS

11. The main control surfaces such as Aileron and Elevators of a fixed-wing aircraft are attached to the airframe on hinges or tracks so that they may move and thereby deflect the air stream passing over them.

AILERONS

12. The figure below shows the position of Aileron and Elevator on an aircraft.



13. Ailerons are mounted on the trailing edge of each wing near the wingtips and move in opposite directions. When the pilot moves the stick left, the left aileron goes up and the right aileron goes down. A raised aileron reduces lift on that wing and a lowered one increases lift, so moving the stick left causes the left wing to drop and the right wing to rise. This causes the aircraft to roll to the left and begin to turn to the left.

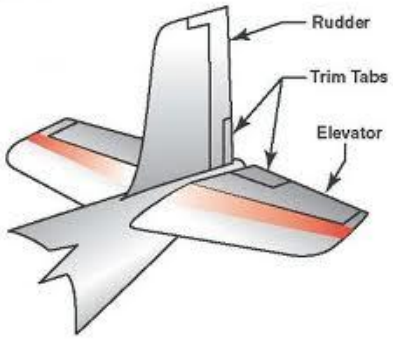
ELEVATORS

14. An elevator is mounted on the trailing edge of the horizontal stabilizer on each side of the fin in the tail, as shown in the figure above. They move up and down together. When the pilot pulls the stick backward, the elevators go up. Pushing the stick forward causes the elevators to go down. Raised elevators push down on the tail and cause the nose to pitch up.

RUDDERS

15. The **rudder** is a fundamental control surface in order to provide means of controlling yaw of an airplane about its vertical axis.

16. A typical view of Rudder is shown below.



17. The **rudder** is a control surface which is controlled by pedals rather than at the stick. It is the primary means of controlling yaw-the rotation of an airplane about its vertical axis. On an aircraft, the **rudder** is a directional control surface. The rudder is usually attached to the fin which allows the pilot to control yaw about the vertical axis.

LANDING GEAR

18. The **undercarriage** or **landing gear** in aviation is the structure that supports an aircraft on the ground and allows it to taxi, take-off and land. Typically wheels are used, but skids, skis, floats or a combination of these and other elements can be deployed, depending on the surface.

TYPES OF LANDING GEAR

19. A typical landing gear is shown below.

20. A **Landing gear** can be classified in to two types as follows:

(a) **Fixed Landing gear**. A fixed gear always remains extended and has the advantage of simplicity combined with low maintenance.

(b) **Retractable Landing gear**. To decrease drag in flight, some undercarriages retract into the wings and/or fuselage with wheels flush against the surface or concealed behind doors. This is called retractable gear.

CONCLUSION

21. The fuselage is an aircraft's main body section that holds crew and passengers or cargo. In single-engine aircraft it will usually contain an engine The fuselage also serves to position control and stabilization surfaces in specific relationships to lifting surfaces, required for aircraft stability and maneuverability Since fuselage is the main attachment point for wing attachment, landing gear, stringers, bulk head/formers etc, its basic design and selection of materials play a major role in deciding the strength of aircraft.

CHAPTER – VI

AIRCRAFT PARTICULARS

AIRCRAFT PARTICULARS

(AP-1)

Period	--	I
Type	--	Lecture
Term	--	I/I
Revised by	--	

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Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Aircraft Particulars	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

INTRODUCTION (Slide 01)

3. The particulars of some of the aircraft are given in the subsequent paragraphs.

AIM (Slide 02)

4. To have better knowledge about the different types Aircraft in use.

MIRAGE 2000

Role: Single Seater Air Combat.

Particulars:

Length/Span/Height--	14.5 / 9.0/ 3.4 Metres
Max Take-Off Weight--	16,500 Kgs
Fuel Capacity--	3800 + 2 X 1700 Litres(Drop Tanks)
Pay Load--	6000 Kgs(Four missiles + 2 X 20 mm DEFA guns)

Performance:

Max Speed--	Mach 2.35 at 11 Km altitude.
Range--	1480 Km
Engine (Thrust)--	One Turbo-fan (9700 kg)

Special Features

- Nine hard-points for pay load, two under each wing and five under fuselage, a rare feature of any combat aircraft.
- French design, inducted into IAF in 1987.

JAGUAR

Role: Deep penetration strike aircraft.

Particulars:

Length/Span/Height--	16.95 /8.7/ 4.8 Metres
Max Take-Off Weight--	15,700 Kgs
Fuel Capacity--	4200 + 3 X 1200 Litres(Drop Tanks)
Pay Load--	4,750 Kgs(2 X 30 mm ADEN guns)

Performance:

Max Speed--	1350 kmph.
Range--	3500 Km
Engine (Thrust)--	Two Turbojet (3810 kg each)

Special Features

- Seven hard-points, four under each wing, one under fuselage and two over wings(a unique feature).
- UK-France design, built under licence by HAL.

LIGHT COMBAT AIRCRAFT (LCA)

Role: Single Seater Multi Role Combat.

Particulars:

Length/Span/Height--	13.2 / 8.2/ 4.4 Metres
Max Take-Off Weight--	8,500 Kgs
Pay Load--	4000 Kgs(Beyond-Visual-Range missiles, Reconnaissance/Electronic Warfare pods and 23 mm GSH gun.

Performance:

- Single engine aircraft expected to be supersonic at all altitude.
- Small size will reduce its chances of detection by enemy radars.
- Capable of Take-off and landing from very short runways.
- Inertial navigation system for accurate navigation and guidance.
- In flight refuelling probe for extended range.

Special Features

- Once in the air, it shall be world's smallest light weight and highly manoeuvrable combat aircraft with seven hard-points.
- It is being developed by aeronautical development agency with contribution from more than 100 government/private agencies.

IL - 76

Role: Heavy Duty, Long Range Transport.

Particulars:

Length/Span/Height--	46.6 / 50.5/ 14.8 Metres
Max Take-Off Weight--	1,70,000 Kgs
Fuel Capacity--	51,300 Litres
Pay Load--	40,000 Kgs(upto 225 para-troopers)

Performance:

Cruise Speed--	850 Kmph
Range--	6,500 Km
Engine (Power)--	Four Turbo-fans (12000 Kg each)

Special Features

- Three IL-76 can airlift an entire infantry battalion with its equipment and ammunition across the sub-continent in a few hours.
  It carries 2 X 23 mm guns in the tail.

EMBRAER(135-BJ)

Role: Passenger version transport aircraft to carry the passengers.

Particulars:

Length/Span--	86.5 /68.92Metres
Fuel Capacity--	8314 Litres

Special Features:

- It can carry 19 passengers.

BOEING-737-200

Role: It is an American Transport aircraft used by the IAC on its internal routes in India to carry the passengers.

Particulars:

Length/Span/Height--	30.48 /28.35/ 11.28 Metres
Fuel Capacity--	26,026Litres
Pay Load--	15544 Kgs

Performance:

Max/Cruise Speed-- 940/845 Kmph

Range-- 3555 Km

Engine (Power)-- Two Pratt & Whitney Turbo-fans (6575 Kg)

Special Features

- It accommodates up to 119 passengers with a crew of two, or carries 15544kg of cargo in all cargo version.

KAMOV (Ka-25)

Role: Anti-Submarine warfare.

Particulars:

Length/Height-- 9.75 / 5.37 Metres

Max Take-Off Weight-- 7500 Kgs

Pay Load-- Dipping Sonar, Search radar, Air to Surface guided missiles.

Performance:

Cruise/Max Speed-- 193/209 KMPH

Range-- 400 Km

Engine (Thrust)-- Two Turbo shafts(900 hp each)

Special Features

- It does not have any tail rotor. Instead it has two sets of main rotor blades rotating in opposite direction.
- Main rotor blades can be folded for ease of storage.

MI-26

Role: Heavy Lift Helicopter.

Particulars:

Length/Height--	33.7 / 8.6 Metres
Max Take-Off Weight--	56000 Kgs
Pay Load--	20000 Kgs (70 Combat Troops)

Performance:

Cruise/Max Speed--	255/295 KMPH
Range--	800 Km
Engine (Thrust)--	Two Turbo shafts(11400 HP each)

Special Features

- Main rotor has eight blades and tail rotor has five blades.
- Normal crew of five consisting of pilot, co-pilot, flight engineer, navigator and load master.

MI-25

Role: Fighter Helicopter.

Particulars:

Length/Height--	17.50 / 6.5 Metres
Fuel Capacity--	2055 Litres

CHAPTER – VII

AIRFIELD LAYOUT

AIRFIELD LAYOUT

(AL-1)

Period	-	I
Type	-	Lecture
Term	-	I Year
Revised by	-	

Training Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2. (a)	Introduction		- 05 minute
(b)	Requirement	-	- 05 minute
(c)	Different Parts of Runway		- 20 minute
(d)	Runway markings		- 05 minute
(e)	Conclusion		- 05 minute
	Total		**40 Minute**

INTRODUCTION

(Slide-1)

1. The sitting, layout and physical characteristics of an airfield should facilitate safe, orderly and expeditious flow of air traffic. The basic areas associated with physical characteristics have been standardised for all airfields/aerodromes with subsequent amendments from time to time. The standardised physical characteristics have been worked out considering most of the aircraft available today and standardised by DGCA conforming to international rules and regulations.

AIM

(Slide-2)

2. To teach the cadets about the layout of an Aerodrome and its markings.

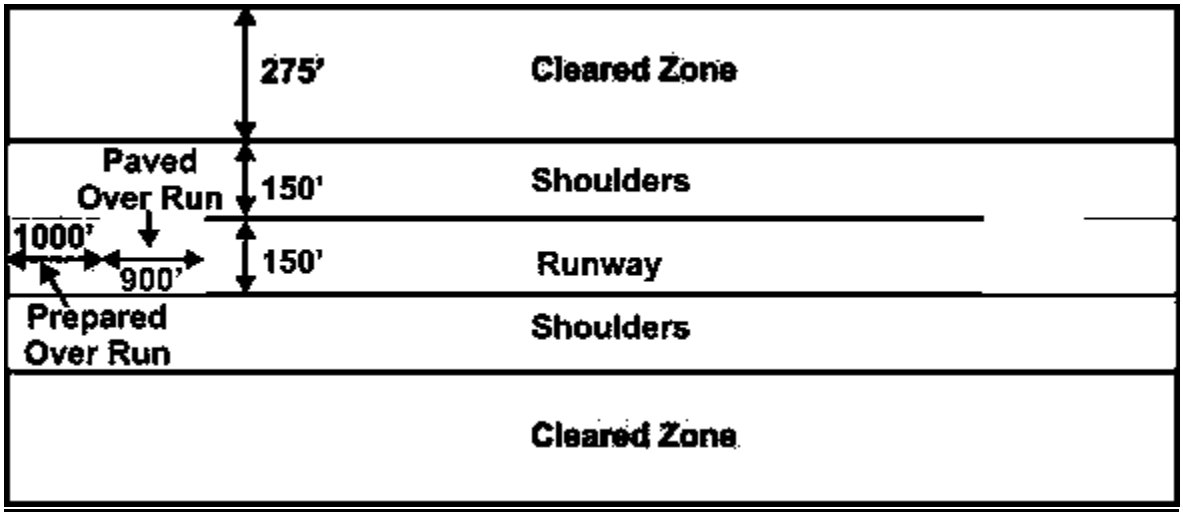
LAYOUT OF AERODROMES/AIRFIELDS

(Slide 3-6)

3. Following are the areas laid down at the airfields to facilitate safe and expeditious conduct of aircraft operations:

(a) **Movement Areas.** Movement areas are that part of an airfield intended for the surface movement of the aircraft. These are paved areas and include runways, taxiways, dispersal areas, aprons.

(b) **Flight Strip.** It is the rectangular portion of an airfield containing the runway and paved over-runs along with the shoulders and cleared zones



(c) Runways. Runways are paved surfaces intended for take-off and landing run of ac. The number and orientation of runways at an airfield will depend upon the volume of traffic, runway occupancy time and climatological data on surface winds.

(d) **Taxiways.** These are paved surfaces provided for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another.

(e) **Shoulders.** These are areas immediately adjacent to the edges of the runway, taxiways, over-runs and SGAs prepared for accidental or emergency use in the event of an aircraft running off the paved surface.

(f) **Cleared Zones.** These are those areas of the flight strip adjacent to the shoulders which for safety of aircraft operations, should be levelled and be free of obstructions as far as possible.

(g) **Over-Run Areas.** A defined rectangular area on ground at the end of runway in the direction of take-off prepared as a suitable area in which an aircraft can be stopped in case of abandoned take off, or during a landing emergency.

AERODROME MARKINGS

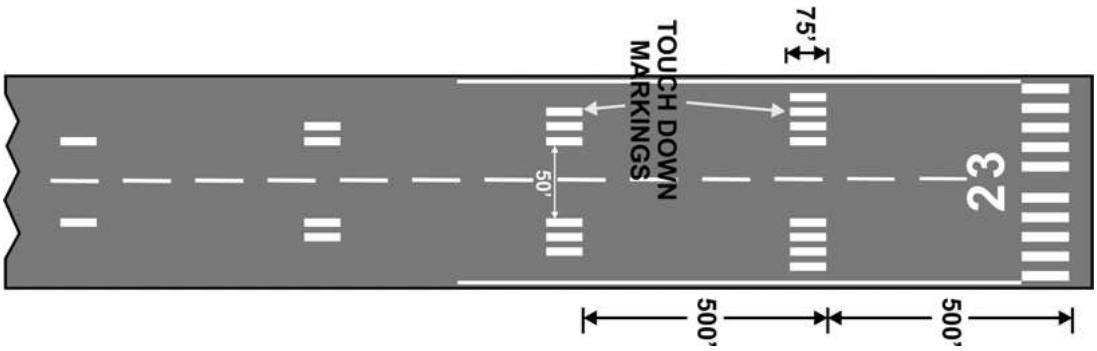
(Slide 7-10)

4. Aerodrome markings consist of signs on surface of movement areas to convey aeronautical information.

5. Aerodrome ground markings shall consist of the following:

(a) Runway markings.
(b) Taxiway markings.
(c) Unserviceability markings.

Runway Markings



6. Runway markings shall consist of:

(a) **Runway designation markings.** Runway designation markings shall consist of a two-digit number and on parallel runways shall be supplemented by a letter. The two-digit number shall be the whole number nearest to one tenth of magnetic azimuth of centre line measured clockwise from magnetic North when viewed from direction of approach.

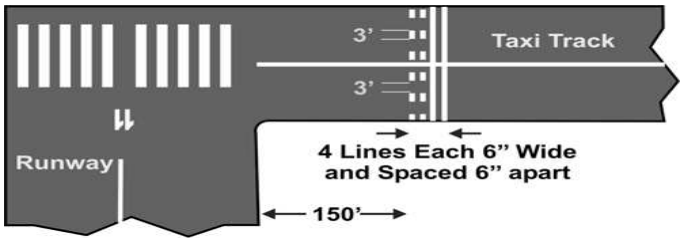
(b) **Runway centre line markings.** Runway centre line markings shall consist of a series of broken longitudinal lines along the runway centre line and extending along the whole length of the runway

(c) **Runway threshold markings.** The markings shall consist of a series of longitudinal strips of uniform dimensions symmetrically placed on both sides of runway centre line and extending laterally to 1.5 m (5 ft) from the edge of runway.

(d) **Runway touch down zone markings.** Touch down zone markings shall be located over the first 600 m (2000 ft) of instrument runways at longitudinal spacing of 150 m (500 ft). These markings shall be provided with distance coding

(i) **Runway side strip markings.** Side strip markings shall be provided on all paved runways. These markings shall consist of two lines extending the whole length of the runway parallel to and equidistant from runway centre line

7. **Taxiway Markings** These markings shall consist of:
(a) Taxiway centre line markings.
(b) Runway holding position markings.

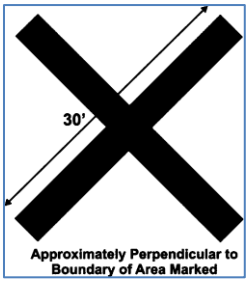


8. **Taxiway Centre Line Markings.** These markings shall be single unbroken lines 0.15 m (6") wide along the centre line of taxiway.

9. **Runway Holding Position Markings.** These markings shall consist of four lines of 0.15 m (6") width each with spacing of 0.15 m (6").

Unserviceability Markings

10. Unserviceability markings shall be displayed on those parts of movement area, which are unfit for landing, take-off or surface movement of aircraft. Unserviceability markings shall be in the form of a cross as given below



Aerodrome Lighting: there are several types of approach and airfield lighting in use in the service. All permanent installations are normally on the mains electricity supply but also have some alternative arrangements for use in the event of power failure. Aerodrome lighting is considered under two headings.

(a) **Approach lighting:** this is to assist the pilots to make an approach for landing in poor visibility or at night.

(b)**Airfield lightings**: modern installation consist of raised high intensity white lights along each side of the runway, beamed towards the landing aircraft. At the beginning of runway, called the thresh hold, is a bar of green lights going across the full width of the runway.

CONCLUSION

(Slide-11)

11. The concept of airfields has changed considerably since the early days of flying. The aircraft of yester years needed comparatively small, level grass areas. When these airfields were built, the number of cross wind landing was reduced by building a triangular pattern of three runways, the longest of which was usually in line with the prevailing winds. But as the aircraft became faster, their landing and take-off runs became longer and the airfields had to be enlarged to meet their ends. With faster approach and landing speeds of aircraft, the lengths of runway became more important factor than the wind direction. The modern tendency, therefore, is for operations to be confined to one or at the most two runways on the each airfield. The longest of these runways is usually designed for instrument landings in bad weather and it is known as instrument runway having full, lighting, radio, radar and instrument landing facilities .Today the runways are even more than 6000 yds long and 200 ft wide and constructed of concrete surface with asphalt to give a clean and smooth operating surface.

CHAPTER – VIII

ATMOSPHERE (MET)

ATMOSPHERE

(MET-1)

Period - I

Type - Lecture

Year - II

Revised by -

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mts
	(b)	Atmosphere – Composition of Air	-	10 mts
	(c)	Layers of atmosphere	-	10 mts
	(d)	Atmospheric pressure	-	10 mts
	(e)	Conclusion	-	05 mts
		Total		40 mts

INTRODUCTION

3. The invisible and odorless gas which we breathe, which sustains life and produces an infinite variety of phenomena is what we call air. The envelope of air surrounding the earth and extending to great heights is the atmosphere where vast physical processes occur, giving rise to the ever changing weather phenomena.

AIM

4. To teach the cadets about atmosphere, its air composition, layers of atmosphere and atmospheric pressure.

PREVIEW

5. The lecture will be conducted in the following parts:-

(a) Part-I: Composition of air.

(b) Part-II: Layers of atmosphere.

(c) Part-III: Atmospheric pressure.

COMPOSITION OF AIR

6. Air is a mechanical mixture of a variety of gases. The main constituents of this mixture are nitrogen and oxygen, accounting for almost 99% of the whole, with roughly three parts of nitrogen to one part of oxygen. There are small amounts or traces of other gases. This composition is more or less the same upto about 60 kilometers.

7. The percentage of composition of dry air by volume is in the proportions as shown below:-

Nitrogen	-	78.09 %
Oxygen	-	20.95 %
Argon	-	0.93 %
Carbon dioxide	-	0.03 %

8. The atmosphere is never completely dry. Water vapours are always present in varying amounts. Water vapours also behave as a gas. It is the change in the amount and state of the water vapours (solid, liquid, gas) which is important in the physics of the weather processes in the atmosphere. Apart from water vapours suspended particles like dust, smoke and other impurities affect the transparency of the atmosphere causing reduction in visibility.

9. In the higher layers there is a concentration of Ozone between 30 and 50 km.

LAYERS OF ATMOSPHERE

10. While the pressure and density decrease as the height increases, the variation of temperature is different. Due to this there is a tendency for the atmosphere to be divided into several spheres as mentioned below:-

(a) Troposphere - Up to about 11-16 km

(b) Stratosphere - Up to about 50 km above troposphere

(c) Mesosphere - 50 to 85 km

(d) Thermosphere - Above 85 km

11. **Troposphere**: The troposphere is the region nearest to the earth and is generally the region of weather. It has a more or less uniform decrease of temperature with height. The lapse rate is roughly 6.5°c /km (1.98°c /1000feet). The upper boundary of the troposphere is called the tropopause whose height varies from equator to the poles, being highest at the equator (16-18 km) and lowest over poles (8-10 km).

12. **Stratosphere**: The stratosphere is the layer extending from the tropopause to about 50 km. the temperature in this region is steady or increases with height. In the higher stratosphere the temperature is of the order of 0°c. The upper boundary of the stratosphere is the stratopause.

13. **Mesosphere**: The layer above the stratosphere is the mesosphere, where the temperature again decreases with height. The boundary of the mesosphere is the mesopause, about 85 km high, where the lowest temperatures in the atmosphere are found (about - 90°c).

14. **Thermosphere**: Above the mesosphere is the thermosphere. Its upper limit is undefined. However at about 700 km, the gravitational pull of the earth is practically absent and the particles can escape from the atmosphere into space. This region is often referred to as exosphere.

15. **Ionosphere**: The lower thermosphere is in a highly ionized state and is hence called ionosphere. This layer causes reflection of radio waves and makes long wave radio communication possible.

16. **International Standard Atmosphere**: A standard average atmosphere has to be specified for various purposes like the design and testing of aircraft, evaluation of aircraft performance, calibration of pressure altimeter etc. For this purpose a standard atmosphere is defined and used as a basis of references. The most widely used atmosphere for reference purposes is the one defined by ICAO, known as International Standard Atmosphere (ISA) whose specifications are :-

Mean Sea level temperature	-	15°c
Mean Sea level pressure	-	1013.25 mb
Surface density	-	1225 g/m3
Acceleration due to gravity	-	980.665 cm / sec2
Rate of fall of temp with height up to 11 km	-	6.5°c /km (1.98°c / 1000)

ATMOSPHERIC PRESSURE

17. Pressure as weight of the air above: Atmospheric pressure at any level in the atmosphere refers to the weight of the column of air of unit cross section vertically above the point of observation. In other words air has weight and therefore exerts a pressure which is equivalent to a column of air extending vertically till the total height of atmosphere. This pressure is expressed in various units like millibars, pounds per square inch etc.

18. When an aircraft climbs away from the earth surface the height of the column of air above it decreases and therefore the weight and pressure exerted by that column decreases (Atmospheric pressure decreases with height). This rate of decrease of atmospheric pressure is found to be 1millibar for every 30 feet of height (and vice-versa).

CONCLUSION

19. The atmosphere extends from the surface of earth till about 500 miles. Troposphere is the layer closest to earth surface and is most important to aviation. Weather processes occurring in troposphere affects aviation. Atmospheric pressure vary from place to place depending on temperature and cause high pressure and low pressure areas. Air moves from high pressure to low pressure area and this motion of air is called wind. Wind has both direction and speed.

CHAPTER – IX

MAPS

MAPS

(MP-1)

Period - I

Type - Lecture

Year - II

Revised by -

Trg Aids

1. Computer slides, pointer, black board, chalk, different scale maps and charts.

Time Plan

2.	(a)	Intro	-	05 mts
	(b)	Types of maps	-	10 mts
	(c)	Different symbols used in maps	-	10 mts
	(d)	Different scales of topographical maps	-	10 mts
	(e)	Conclusion	-	05 mts
		Total		40 mts

INTRODUCTION (Slide 1)

3. Topographical map is one in which a good pictorial representation of a country is portrayed and is provided mainly to be used for map reading.

AIM (Slide 2)

4. To teach the cadets about types of maps, different symbols used in maps and different scales of maps.

PREVIEW (Slide 3)

5. The lecture will be conducted in the following parts:-

(a) Part-I : Types of maps
(b) Part-II : Symbols used
(c) Part-III : Scales of maps

TYPES OF MAPS (Slide 4-6)

6. The four basic elements required in a map are:

(a) Areas will be shown correctly

(b) Bearing measurement anywhere on the reduced earth will be identical to the measurement on the earth.

(c) Shapes will be correct

(d) Distances will be measured accurately by use of a graduated scale which is provided at the bottom of each map. The distances are given in (1) Kilometers (2) Nautical miles (3) Statute miles

7. In aviation both maps and charts are used for Navigation. When a projection has a graticule of latitudes, longitudes and an abundance of ground features it is called a map. A chart has a projection on which it contains a graticule of latitude and longitude with very few geographical features.

8. **Relief :** Mountains, hills, coast lines and other natural features are of considerable interest to a pilot as they are valuable landmarks for navigation purpose or are, sometimes pose dangerous barriers for flight. Relief is indicated on maps and charts in one or more of five different ways:

(a) Spot heights or depths

(b) Contours and form lines

(c) Layer tints

(d) Hachures

(e) Hill shading

Spot heights and depths: These are shown against places where the exact height above sea level or depth below mean sea level has been measured. On some maps, heights are recorded in feet. On other maps the height is recorded in meters. One has to be very particular to note the units of heights shown on maps.

Contours and form lines: Contours are lines joining all places having the same heights above a certain datum level. When these lines are shown approximately then they are known as form lines. The closeness of the contours on a map shows the steepness of any hill. Where the changes of height is rapid, the contours will be closer than on slopes where they are spaced.

Layer tints: These are commonly used on maps to show relief. Layers of earth between certain contours are coloured with the tint intensifying with successive increase in height. Thus at a glance, a map will indicate major irregularities in the surface of the country.

Hachures: These are short, tapering lines drawn on maps and they radiate from peaks and high ground. They only serve to show slopes.

Hill shading: This is produced by assuming that a bright light is shining across the map sheet so that shadows are cast by all high ground on its lower side. The effect is to give the map something of a stereoscopic appearance by optical illusion. These shadows obliterate other details on the map and are not commonly used.

SYMBOLS USED IN MAPS (Slide 7-9)

9. The details on topographical maps are shown by symbols. Some of which are pictorial in nature, while others are given by a symbol which is accepted internationally. These symbols are used to denote the details of a map and these are called as conventional signs.

10. The signs are uniform on all maps but the colour used may vary on different scale maps. Therefore, it is difficult to give a complete list of conventional signs used on various maps. However, all maps have a list of signs marked on the side of map and these should be studied before using the map for reading purposes.

11. Knowing the amount of details to be expected on maps of different scales and given knowledge of conventional signs by which that detail is indicated, the map reader is in a position to appreciate the relative value of the feature seen on the ground. The beginner is sometimes confused by the amount of detail confronting to his untrained eye. He must learn to distinguish the more significant features and to remain undistracted by irrelevant back ground. The following may help to indicate the types of which is of value to the map reader.

(a) Coast line (b) Water Features (c) Mountains and hills

(d) Towns and Villages (e) Railways (f) Roads

(g) Wooded areas.

SCALES OF MAPS (Slide 10-11)

12. The scale is the ratio of a distance measured on the map to the corresponding distance on the earth surface. Scales on a map is represented commonly by (1) representative fraction (2) graduated scale line or by (3) statement in words.

13. Most common maps used in aviation are ¼ million maps, ½ million maps and 1 million maps. ¼ million maps have larger scale than ½ million and ½ million have scale larger than 1 million. A larger scale map represents comparatively lesser ground distance and consequently more ground details can be inserted.

CONCLUSION (Slide 12)

14. Maps and charts are used for plotting and planning purposes in navigation. It is essential to understand various scales, symbols and methods by which relief features are represented in a map for effective planning and subsequent reading. Before execution of navigation sortie a pilot must thoroughly go through map preparation, distance measurement and other calculations to be able to conclude the sortie accurately.

CHAPTER – X

RT PROCEDURE

RT PROCEDURE
(RT-1)

Period	-	II
Type	-	Lecture
Term	-	I Year
Revised by	-	

Training Aids

1. Computer slides pointer, white board, board marker and duster

Time Plan

2.	(a)	Introduction	- 05 minute
	(b)	Definitions	- 10 minute
	(c)	Functions	- 15 minute
	(d)	Pronunciations	-06 minute
	(e)	Conclusion	- 04 minute
		Total	**40 Minute**

INTRODUCTION:

(Slide 1)

1. As an Air Wing NCC cadet it is must to know about ATC &RT procedure prior to start flying. Timely information of weather, wind speed and position are essential parameters for flying. To access all the timely required information for a safe operation we must know the ATC & RT procedure.

AIM

(Slide 2)

2. To acquaint the cadets about the ATS definitions, functions, procedure and standard phraseologies used while communication between aircraft and the ground staff.

DEFINITIONS

(Slide 3-7)

3. **Air Traffic Services.** Services provided for the safe and efficient conduct of flight are termed as air traffic services.

4. **Objectives of Air Traffic Services.**

(a) To prevent collision between aircraft.
(b) To prevent collision between aircraft on the manoeuvring area and obstructions on that area.
(c) To expedite and maintain an orderly flow of traffic.
(d) To provide advice and information useful for the safe and efficient conduct of flights.
(e) To notify appropriate organisations regarding aircraft in need of search and rescue aid and assist such organisation as required.

5. **The ATS include the following:**

(a) Air Traffic Control Services:
    (i) Area Control Service.
    (ii) Approach Control Service.
    (iii) Aerodrome Control Service.
(b) Flight Information Service.
(c) Air Traffic Advisory Service.
(d) Alerting Service.

6. **Air Traffic Control Service.** A service provided for the purpose of:

(a) Preventing collisions between aircraft.
(b) Prevent collisions on the manoeuvring area between aircraft and obstructions.
(c) Expediting and maintaining an orderly flow of air traffic.

7. **Area Control Service.** ATS service for controlled flights in control areas.

8. **Approach Control Service.** ATC service for arriving or departing controlled flights.

9. **Aerodrome Control Service.** ATC service for aerodrome traffic.

10. **Flight Information Service (FIS).** A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. Flight information service shall include the provision of pertinent information such as: Sigmet information, Nav aids, aerodromes facilities, weather etc.

11. **Air Traffic Advisory Service.** A service provided within advisory airspace to ensure separation, in so far as possible, between aircraft which are operating in IFR flight plans.

12. **Alerting Service.** Provided to notify appropriate organisations regarding aircraft in need of search and rescue and assist such organisations when required.

13. **Air Traffic Service Units.**

(a) **Area Control Centre.** A unit established to provide air traffic control service to controlled flights, in control areas, under its jurisdiction.

(b) **Approach Control Office.** A unit established to provide air traffic control service to controlled flights arriving at or departing from, one or more aerodromes.

(c) **Aerodrome Control Tower.** A unit established to provide air traffic control service to aerodrome traffic.

(d) **Flight Information Centre.** A unit established to provide flight information service.

14. **Jurisdiction of Various ATS Units.**

(a) **Control Area.** An airspace of defined dimensions extending upwards from specified limit above the earth, within which control service is provided to controlled flights.

(b) **Control Zone.** An airspace of defined dimensions extending upwards from the surface of the earth to a specified upper limit, within which Air Traffic Control Service is provided to controlled flights.

(c) **Aerodrome Traffic Zone.** Airspace of defined dimensions established around an aerodrome for the protection of aerodrome traffic.

(d) **Flight Information Region.** Airspace of defined dimensions with in which flight information service and alerting service are provided.

(e) **Advisory Airspace.**

(i) **Advisory area.** A designated area within a flight information region where air traffic advisory service is available.

(ii) **Advisory route.** A route within a flight information region along which air traffic advisory service is available.

15. **Responsibilities of the Various A.T.S. Units.** In India the responsibilities of the Area Control Centres are:-

(a) Providing flight information service to aircraft in flights within its region.
(b) Providing Air Traffic Control Service to controlled flights within control areas under its jurisdictions.
(c) Maintaining up-to-date aeronautical information regarding aerodromes and facilities within its region.
(d) Obtaining current weather information.
(e) Handling and assisting diversions of aircraft within its region.
(f) Initiating search and rescue.

16. **Aerodrome Control Tower.** It is responsible for:

(a) Control of all traffic (aircraft vehicular and pedestrian) on the manoeuvring area of the aerodrome.

(b) Control of aircraft flying in the vicinity of the aerodrome in VMC.

17. **Approach Control.** It is the provision of air traffic control service for the parts of the controlled flights associated with arrivals or departures.

18. **Area Control** The organisation responsible to provide ATC service to controlled flights in control area is known as “Area Control Centre” Control areas include airways and TMAs (Terminal Manoeuvring Areas).

19. **Functions of Area Control.**

(a) Issuance of ATC clearance for the purpose of preventing collisions between controlled flights under its control and jurisdiction.
(b) To expedite and maintain an orderly flow of traffic of flights provided with area control service.
(c) To provide flight information service.
(d) To provide air traffic advisory service, if required, in advisory area and routes after proper co-ordination with the concerned FIC.
(e) Alerting service.

Airways Control

(Slide 11-15)

20. Area Control Service provided to controlled flight in their en-route phase is termed as airways control. To extend area control to en-route traffic, controlled airspace in the form of ‘Corridors’ are established and defined with radio navigational aids. Such Corridors are known as Airways’ and have specified lower and upper limits. An airways extends along a track starting from one navigational aid to another or through series of navigational aids. The width or lateral dimension of airways vary from 8 km to 20 km (4 nm to 10 nm) on either side of the track. An airway in 10 nm wide over land and 20 nm

wide over sea / oceans. This width depends on the accuracies of the navigational aids available along the route.

TMA

21. When different airways approach in the vicinity of one more major aerodromes, the resultant terminal airspace is protected and control area is established. Such controlled areas at the confluence of airways are called “Terminal Manoeuvring Areas” (TMA). TMAs are suitably lined with control zones of the aerodromes, located in terminal airspace to facilitate the provision of approach control service for flights arriving at and departing from these aerodromes.

Transfer of Control

23. Transfer of control from one ATCC / ACC to another takes place:

(a) At an agreed airways reporting point.
(b) At the estimated time given for FIR boundary
(c) At any other agreed D/R position / location.

24. An ATCC transferring control of an aircraft should pass an estimate for the arrival of such aircraft at the transfer point to the next ATCC / ACC 30 minutes ahead of aircraft’s actual passage and on subsequent revision to this estimate in excess of 3 minutes.

25. If 30 minutes prior intimation cannot be given an ‘approach acceptance’ request shall be made to the ATCC / ACC accepting/taking over control of aircraft.

26. Instruction regarding the transfer of communication will normally be given to aircraft 5 minutes before the ETA over transfer point.

RT PROCEDURES AND PHRASEOLOGY

28. **Radio Communication Standard Phraseologies.**

(Slide 16-18)

1. **Spelling Alphabets.** When proper names, service abbreviations and words of which the spelling is doubtful are spelled out in Radio Telephony (RT) the following alphabet shall be used: **Letter to be Identified**	**Identifying Word**	**Representation of Pronunciation in English**
A	Alfa	Alphah
B	Bravo	BrahVoh
C	Charlie	Charlee (or Shar Lee)
D	Delta	Dell Tah
E	Echo	Eck Oh
F	Foxtrot	Foks Trot
G	Golf	Golf
H	Hotel	Hoh tell
I	India	In Dee Ah
J	Juliet	Jew Lee Et
K	Kilo	Key Loh
L	Lima	Lee Mah
M	Mike	Mike
N	November	No Vem Bar
O	Oscar	Oss Car
P	Papa	PahPah
Q	Quebec	Qeh Beck
R	Romeo	Row Me Oh
S	Sierra	See Airrah
T	Tango	Tang Go
U	Uniform	You Nee Form
V	Victor	VikTah
W	Whiskey	Wiss Key
X	X-Ray	Ecks Ray
Y	Yankee	Yan Key
Z	Zulu	Zoo Loo

2. **Pronunciation of Numbers.**		
1	One	Wun
2	Two	Too
3	Three	Tree
4	Four	Fower
5	Five	Fife
6	Six	Six
7	Seven	Saveen
8	Eight	Ait
9	Nine	Niner
0	Zero	Zee Row
.	Decimal	Day - See - Mal
1000	Thousand	Tou - sond

3. All numbers except whole thousand will be transmitted by pronouncing each number separately. Whole thousands shall be transmitted by pronouncing each digit in the number of thousand followed by the word thousand. Some of the examples are **Number**	**Spoken As**
10	One Zero
75	Seven Five
100	One Zero Zero
583	Five Eight Three
5000	Five Thousand
25000	Two Five Thousand

CONCLUSION

(Slide-19)

51. Standard phraseology is recommended in the interest of clarity and brevity. The use of standard phrases does provide uniformity in transmission and makes your transmission more readily understood by ground station operator and vice versa. Correct procedure on the part of operators of radio telephony equipment is necessary for the efficient exchange of communication and is particularly important where lives and property are at stake. It is also essential for a sharing of “on the air” time in the crowded radio spectrum.

CHAPTER – XI
AEROMODELLING

HISTORY OF AEROMODELLING

(AM-1)

Period	--	I
Type	--	Lecture
Term	--	I/I
Revised by	--	

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Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	History of Aeromodelling	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"When once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return." ***- Leonardo da Vinci***

INTRODUCTION (Slide 01)

3. Aeromodelling is one of the finest & costly hobbies, which is very popular worldwide among people of all ages and professions. It has often been the starting point of many pilot and aero-nautical engineer. The aims of including aeromodelling in the NCC curriculum are to increase the air mindedness in the youth of our country. If taken on the right lines, it can be extremely thrilling for all, as by constructing the models by one's own hands, will make understanding of various principles of flight and problems of construction etc., very easy, apart from providing great personal satisfaction to the aero-modeler.

AIM (Slide 02)

4. To know better knowledge the history of aeromodelling and flying objects.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

(a) History of Aeromodelling

HISTORY OF AEROMODELLING (Slide 04)

6. The history of aeromodelling goes back much further than the history of real aircraft. The successful experiments, however, started in the nineteenth century. Dr. Thomas Young was the first person to discover the 'lifting' property of a cambered surface in comparison to the flat surface. Sir George Caley built a helicopter model, based on a design of Leonardo-da-vinci, in 1796. Another aeromodelling genius was John String fellow, who built, in 1842, a small spring 'Operated model', followed by a number of different and bigger models, powered by 2-stroke as well as steam engines. Another great name amongst the pioneers of aeromodelling is of Alphones Penand, who invented models fitted with tail surfaces and wings with dihedral angles. This gave substantial stability of flight to aero models, which till this time had lasted for very short duration. Next came energy, enthusiasm and tenacity of purpose which earned him the distinction of being the most active champion of glider flying. After this, came the era of miniature petrol-driven engines. In 1878, Professor Langley builds a petrol driven model called 'Aerodrome No.5'. This revolutionalised the concept of aeromodelling, as there was now an ideal power plant small enough for the requirement, available to the enthusiasts. Hundreds of varieties of petrol models were subsequently built. Later, these gave ways to more powerful diesel engines, which are in use even today.

CONCLUSION (Slide 05)

The 'aeromodelling' provides an earnest approach to the understanding of an otherwise highly technical subject, i.e. 'aerodynamics. The 'air-minded' aeromodeller of today is the potential aircraft designer of tomorrow. Although, aeromodelling is a technical hobby and is usually cluttered up with complicated calculations and formulae, it need not necessarily discourage the beginners and the non-technical persons, as they can still derive immense pleasure and satisfaction from this hobby. Aeromodelling is becoming increasingly popular all over the country especially amongst the NCC Air wing cadets.

MATERIALS USED IN AEROMODELLING
(AM-2)

Period	--	I
Type	--	Lecture
Term	--	I/II
Revised by	--	

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Materials used in Aero Modelling	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"Do not let yourself be forced into doing anything before you are ready."- Wilbur Wright

INTRODUCTION (Slide 01)

3. Aeromodelling requires a variety of materials. Selection of correct material and proper use of the same is important factor of Aeromodelling.

AIM (Slide 02)

4. To have knowledge of materials and tools used for building miniature flying objects.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

   (a) Materials used in aeromodelling.

MATERIALS USED IN AEROMODELLING (Slide 04)

6. The following are the main substances from which the Aeromodels can be made:

i. Balsa Wood
ii. Spruce
iii. Japanica Wood
iv. Ply wood
v. Cement
vi. Fast Setting Epoxy
vii. Cyanoacrylate Glue (Cyano)
viii. Putty
ix. Metal paste
x. Dope
xi. Paint
xii. Sand paper
xiii. Fiber glass
xiv. Carbon Fiber
xv. Silver Foil
xvi Monokote& etc..

Basic tools

i. Screw driver
ii. Hand drill
iii. Sand paper and pins
iv. Pliers
v. Knives with different blades
vi. Different kind of saw
vii. Files
viii. Soldering irons
ix. RC set (Transmitter, Receiver, Servos) etc.

CONCLUSION (Slide 05)

After selection of good materials and required tools one has to handle these tools carefully. Mishandling of tools may cause serious injuries to the Aeromodellers/builders.

TYPES OF AEROMODELS
(AM-3)

Period	--	I
Type	--	Lecture
Term	--	I/I
Revised by	--	

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Types of Aeromodel	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"It is possible to fly without motors, but not without knowledge and skill."- Wilbur Wright

INTRODUCTION (Slide 01)

3. There are quite a number of variants of aeromodels, which are classified according to the role and utility of the particular type. These are static models, gliders, control line models and RC models.

AIM (Slide 02)

4. To have a different experimental approach and excavate different aerodynamic models on flying objects.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

(a) Types of Aeromodelling

TYPES OF AEROMODELLING (Slide04)

The following are the different type of Aeromodels.

6. **Static Modes**:-These are the miniature replicas of original aircrafts. The following aircrafts can be prepared as static models.
   i. Fighter aircraft models
   ii. Transport aircraft models
   iii. Helicopter models

7. **Gliders:** - These are the different types of gliders:-
   (i) Chuck Glider
   (ii) Catapult Glider
   (iii) Towline Glider
   (iv) Free flight Glider

8. **Control Line Models: -**The following are the different types of Control Line model**:-**
   (i) Control Line Aerobatic Model
   (ii) Control Line Speed Model

9. **Radio control Models: -**The following are the different types of Control Line model**:-**
   (i) Radio Control Power
   (ii) Radio Control Glider
   (iii) Radio control Helicopter
   (iv) Jet Powered Model

CONCLUSION (Slide 05)

Building and flying the different types of models would help the aero modeler to improve their aerodynamic knowledge and skills.

FLYING/BUILDING OF AEROMODELS
(AM-4)

Period -- 16

Type -- Lecture

Term --

Revised by --

****

Trg Aids

1. Computer slides, pointer, black board and chalk.

Time Plan

2.	(a)	Intro	-	05 mins
	(b)	Flying / Building of Aero Models	-	30 mins
	(c)	Conclusion	-	05 mins
		Total	**-**	**40 Mins**

"What is chiefly needed is skill rather than machinery."- Wilbur Wright

INTRODDUCTION (Slide 01)

3. Individual personally required to build or construct the models by given design or own design and fly the models by using Fly By Wire / Radio Control set.

AIM (Slide 02)

4. Practical knowledge of building and flying the models.

PREVIEW (Slide 03)

5. The class will be conducted in the following parts:-

   (a) Construction of Static Models

(b) Construction of control line Models

(c) Construction of remote control Models

(d) Flying the Models

CONSTRUCTIONS OF STATIC MODELS (Slide 04)

6. These are the miniature replicas of original aircrafts, full sized aircraft types and attract the best skill of the model maker. The scope of this particular type is boundless and depends upon the ideas of the individual concerned. It requires only an elementary knowledge of carpentry and involves fitting together of various parts as well as finishing and painting of the models.

7. Constructions plans are provided normally with all model kits. These should be studied thoroughly. Then follow the shaping of various parts using sandpaper and sand blocks as shown in the blue print. After which the whole plan is fixed on the drawing board. Then the individual parts are placed on the blue print and make sure it is proper as per the blue print. Parts are then assembled together as per the dimensions provided in the blue print. Dope is applied with brush but only in thin coats two to three times. Sand the excess dope using a fine emery paper.

8. **Painting**: - Apply a coat of surfacer using a brush or spray gun and make sure it has covered all the wooden area. After the surfacer is dried up check for dents and apply putty or metal paste to cover the dents. After it dries up using a wet emery paper, sand the model to get a clean surface till it is suitable for painting. Etch rivet marking as shown in the blue print. Spray a thin layer of base coat and paint the model as per the required colour scheme. Add details, undercarriage, wheels, drop tanks etc& apply lacquer or polish if required.

9. **Demo and Practical**

CONCLUSION

The construction/building of static models is one of the main event in all India level competitions like AIVSC and RDC. In AIVSC, the given static model has to be built in stipulated time and for RDC competition, three different static models have to be built that is fighter, transport and helicopter.

CONSTRUCTIONS OF CONTROL LINE MODELS (Slide 05)

10. Each and every part of a model aero plane is important as it would not function in the absence of even one component. Construction plans are provided normally with all model kits. These should be studied thoroughly. Then follows the actual construction of various parts. The power units are, also available in readymade forms, and are required

to be installed as they are, as per the power/weight combination prescribed by the manufactures

11. First, the whole plan is fixed on to the drawing board. Then the individual parts are fixed on it with the help of pins parts are then glued together with cement. After drying, the various components are assembled together with correct alignment. Sand papers of various grades are used for smoothening out of edges and curves. Patience and meticulous operation is needed at this point. Assemble the bell crank assembly with the lead outs carefully. Model is then covered with sliver foil, monokote or tissue paper. Dope may be applied with brush, in thin coats two to three times.

12. Before engine installation, ensure that the engine compartment is properly treated with paint work. While installing the engine, extreme care is needed to be taken to ensure that the thrust line of the propeller is in line with the fuselage. Out of line thrust will result in the model going hay wire and crashing. Engines are mounted either by projection made of hard wood beams or on screws against the plywood.

13. **Demo and Practical**

CONCLUSION

The construction of control line model is slightly advanced as compared to tow line glider and free flight models. In this model, there is only one control surface for most control line aircraft; the up and down movement of the elevator on the stabilizer. The rudder is set so the aircraft will always pull away from the flier (to help keep the control line taut)

CONSTRUCTIONS OF REMOTE CONTROL MODELS (Slide 06)

14. Each and every part of a model aero plane is important as it would not function in the absence of even one component.

15. Construction plans are provided normally with all model kits. These should be studied thoroughly. Then follows the actual construction of various parts. The power units are, also available in readymade forms, and are required to be installed as they are, as per the power/weight combination prescribed by the manufactures.

16. First, the whole plan is fixed on to the drawing board. Then the individual parts are fixed on it with the help of pins parts are then glued together with cement. After drying, the various components are assembled together with correct alignment. Sand papers of various grades are used for smoothening out of edges and curves. Patience and meticulous operation is needed at this point. Model is then covered with sliver foil, monokote or tissue paper. Dope may be applied with brush, in thin coats two to three times.

17. Before engine installation, ensure that the engine compartment is properly treated with paint work. While installing the engine, extreme care is needed to be taken to ensure that the thrust line of the propeller is in line with the fuselage. Out of line thrust will result in the model going hay wire and crashing. Engines are mounted either by projection made of hard wood beams or on screws against the plywood.

18. Install the Radio-control servos as per the requirement to make sure the control rods should move freely without causing any disturbance to the other control rods. Wrap the receiver and the battery pack in foam and place it in the model in such a way that the CG of the model is correct as per the marking shown in the plan by the manufacturer of the kit. Then assemble the wing using a pairs of rubber bands or nylon screws.

19. **Demo and Practical**

CONCLUSION

This type of model is fitted with radio receiver sets of actuators operate the control surfaces of the model. The radio receiver receives signal from the control box which is operated by the “pilot”. The control box is nothing, but a transmitter with various channels for operating the respective controls including throttle. This way, the model can be operated without physical contact.

FLYING THE MODELS (Slide 07)

20. The necessity of choosing a large field for flying the aero models is obvious. However, trees and wooded areas are the greatest hazards for the aeromodeller. Trees cause air pockets and down-draughts and often ‘suck’ the model into their branches.

21. First check the model for correction of alignment. The wing and tail must be checked from the front and rear for setting and must not be warped or out of plane. Testing is carried out during mid-day when there is little or no wind. The model is held on the point of balance i.e. approximately 1/3rd back from leading edge of the wing, and is gently launched into wind slightly nose down attitude. If the model is set properly and trimmed correctly, it will glide forward gracefully and will land on wheels. Use plasticine or lead weight at the nose and tail for balance as required.

22. Power flight is not advisable till the gliding test is carried out successfully. For trail flight, a small amount of fuel is put into the fuel tank and the engine started by rotating the propeller. And the model launched gently the model should fly short distance and land perfectly.

23. **Demo and practical (Models and field equipment)**

SAFETY CODE

GENERAL

(i) I will not fly my model aircraft in competition or in the presence of spectators until it has been proven to be airworthy by having been previously successfully flight tested.

(ii) I will not fly my model higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right of way to, and avoid flying in the proximity of full scale aircraft. Where necessary an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full scale aircraft.

(ii) Where established, I will abide by the safety rules for the flying site I use, and I will not willfully and deliberately fly my models in a careless, reckless, and/or dangerous manner.

RADIO CONTROL

(i) I will have completed a successful radio equipment ground range check before the first flight of a new or repaired model.

(ii) I will not fly my model aircraft in the presence of spectators until I become a qualified flyer, unless assisted by an experienced helper.

(iii) I will perform my initial turn after takeoff away from the pit, spectator, and parking areas, and I will not thereafter perform maneuvers, flights of any sort, or landing approaches over a pit, spectator, or parking area.

CONTROL LINE

(i) I will subject my complete control system (including safety thong, where applicable) to an inspection and pull test prior to flying.

(ii) I will assure that my flying area is safety clear of all utility wires or poles.

(iii) I will assure that my flying area is safely clear of all non-essential participants and spectators before permitting my engine to be started.

CONCLUSION

The individual has to undergo practically in Aeromodelling workshop to build and in flying field to fly the models