SPECIAL SUBJECT
ARMY

EDITION 2025

SD/SW CADETS' HAND BOOK
NATIONAL CADET CORPS

MASTER INDEX: INDIAN ARMED FORCES

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INDIAN ARMED FORCES

1

CHAPTERWISE INDEX: INDIAN ARMED FORCES

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF I: INTRODUCTION TO INDIAN ARMED FORCES

"The safety, honour and welfare of your country come first, always and every time. The honour, welfare and comfort of the men you command come next. Your own ease, comfort and safety come last, always and every time."

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 05 Mins**
- **Part I : 10 Mins**
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INTRODUCTION

1. The responsibility for national defence rests with the central cabinet. This is discharged through the Ministry of Defence (MoD) which provides the policy framework and wherewithal to the Indian Armed Forces to discharge their responsibilities in the context of the defence of the country. Even though all elements of national defence and national security continuously strive to achieve the assigned roles and tasks, the Defence Services play the most vital role in maintaining sovereignty and territorial integrity of our nation from external and internal threats. Based on the major wars fought, struggles and the present-day relations with our neighbouring countries and strategic allies the Defence forces of our nation have transformed significantly to ensure the compliance to the given mandate. Having read the overview of the current structures of the Indian Armed Forces as discussed in succeeding paragraph the NCC Cadets will be able to appreciate how well these organizations have emerged to meet India's needs of national defence, security, integration and other associated requirements.

2. Even though the responsibility of national defence rests with the central cabinet and is discharged through Ministry of Defence, the President of India is the Supreme Commander of Indian Armed Forces. Like in all other developed and developing countries, the Indian Armed Forces comprises of three main constituents, namely, Indian Army, Indian Navy and Indian Air Force which looks after the multi- dimensional defence needs of the country. Recently appointment of the Chief of Defence Staff (CDS) was established with intention of enhancing tri-service effectiveness, coordination and overall integration of the Indian Armed Forces combat capabilities. CDS is the chief advisor to the Government of India in all matters pertaining to Indian Defence Forces. General Bipin Rawat, PVSM, UYSM, AVSM, YSM, SM, VSM, ADC was appointed as the first CDS on 27 December 2019.

3. Throughout this chapter, we will delve into the history, structure and key functions of each branch of the Indian Armed Forces, enabling the cadet to obtain a basic understanding of these vital national assets.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts: ➢ **Part I: The Indian Army** ➢ **Part II: The Indian Navy** ➢ **Part III: The Indian Air Force**	➢ **Learn about Indian Armed Forces – Army, Navy & Air Force** ➢ **The constituents, organization, key elements and role of Indian Armed Forces**. ➢ **Familiarisation with combat arms, combat support arms and supporting services of Indian Army**.

PART I: THE INDIAN ARMY

4. Indian Army is the land-based branch and the largest component of the Indian Armed Forces. Historically, the army of India was raised under the British Raj in the 19th century by taking the erstwhile 'Presidency Armies' and merging them and bringing them under the Crown. The British Indian Army, as it was called then fought both the World Wars and at many places across the world, courageously and valiantly, winning many laurels as well as respect of all professional armies of that time. The Indian Army, as we know it today, became operational after the country gained independence from British colonialism. As of today, Indian Army is the second largest standing army in the world, with approximately 10 lakh active troops and 9,60,000 reserve troops.

5. The Indian Army Headquarters is located in New Delhi and functions under the Chief of the Army Staff (COAS), a four-star general, who is responsible for the command, control and administration of the Indian Army. He is assisted by a Vice Chief of Army Staff (VCOAS), three Deputy Chiefs of Army Staff, Principal Staff Officers (PSOs) and the Heads of Arms and Services. The Army is divided into six operational commands (field armies) and one Training Command each under the command of a Lieutenant General who has an equal status to the VCOAS working under the control of the Army Headquarters. The Indian Army's primary role is to ensure national security and unity, defend the nation from external aggression and internal threats and maintain peace and security within its borders. It also undertakes humanitarian rescue operations during natural disasters and other disturbances, as well as participates in UN peacekeeping missions.

Soldiers of the Sikh Light Infantry during a Republic Day Parade

6. **Constituents and Organisation**. The Indian Army is divided into six Operational Commands and one Training Command which have subordinate formations namely the Corps, Divisions and Brigades under them. As the names below suggest each operational command is responsible for defence of a specific region or area of our country. Each field Army or command is commanded by an officer of the rank of 'Lieutenant General', who is

known as the Army Commander or General Officer Commanding-in-Chief. These seven commands are:-

Command Insignia	Command Name	Headquarters
	Central Command	Lucknow
	Eastern Command	Kolkata
	Northern Command	Udhampur
	Southern Command	Pune
	South Western Command	Jaipur
	Western Command	Chandimandir
	Army Training Command	Shimla

DID YOU KNOW?

- The British Indian Army was formed on April 1,1895, amalgamating the Bombay, Bengal and Madras Armies established by the British East India Company in the 18th century.
- Before this, India's military history was marked by various regional armies and kingdoms that defended their territories.
- According to the Global Firepower Military Strength Ranking, India is the 4th most powerful country in the World

7. **Components of Indian Army**. The Indian Army has three main constituents namely the Combat Arms, the Combat Support Arms and the Services which are organized in field formations forming the Brigades, Divisions, Corps and Commands. All three together fight the war as a team as part of the field formations. These three key constituents namely the Combat Arm, Combat Support Arm and Services, which are further divided into sub components have their own unique quality and characteristics:-

(a) **Combat Arms**. These are the primary fighting forces of the Army, directly involved in combat operations.

(b) **Supporting Arms**. These support the combat arms by providing essential wherewithal and capabilities vital for war fighting which is not integral to the Combat arms like long range fire power, protection from hostile air craft, mobility and communications in war fighting areas.

(c) **Services**. These units provide logistical and administrative support to the Army, ensuring that combat and supporting arms can function effectively both during war and peace.

8. **Combat Arms**.

(a) **Infantry**. The backbone of the Army is an Infantry man, who fights on foot and is responsible for destroying the enemy in close combat during attack/defence and hold ground.

(b) **Mechanized Infantry**. Combines the mobility of armoured vehicles with the flexibility of Infantry and is an essential component of mobile warfare.

(c) **Armoured Corps**. Equipped with tanks and armoured vehicles, it provides mobility and firepower on the battlefield and is the key element of any battle of manoeuvre.

9. **Combat Support Arms**.

(a) **Artillery**. Provides fire support to combat arms using various types of guns, howitzers and rocket systems.

(b) **Army Aviation Corps**. Used for air assault, combat support, aerial reconnaissance and logistics support and casualty evacuation.

(c) **Corps. of Engineers**. Provides engineering support, including construction, demolition and maintenance of infrastructure.

(d) **Army Air Defence**. Protects the Army from aerial threats using anti-aircraft weapons and missile systems.

(e) **Corps of Signals**. Manages military communications and information systems.

10. **Services**.

(a) **Army Service Corps**. Responsible for logistics, supply and transportation.

(b) **Army Medical Corps**. Provides medical care and health care services for Army personnel during war and during peace.

(c) **Corps of Electronics and Mechanical Engineers**. Maintains and repairs equipment and vehicles.

(d) **Army Ordnance Corps**. Manages the supply of ammunition, weapons and other military equipment.

(e) **Remount and Veterinary Corps**. Manages the care and training of animals used by the Army.

(f) **Judge Advocate General's Department**. Provides legal services and advice to Army.

(g) **Army Dental Corps**. Provides dental care to Army personnel.

(h) **Army Educational Corps**. Responsible for the education and training of Army personnel.

(i) **Corps of Military Police**. Maintains discipline and law enforcement within the Army.

(j) **Army Postal Service**. Manages postal services for the Army.

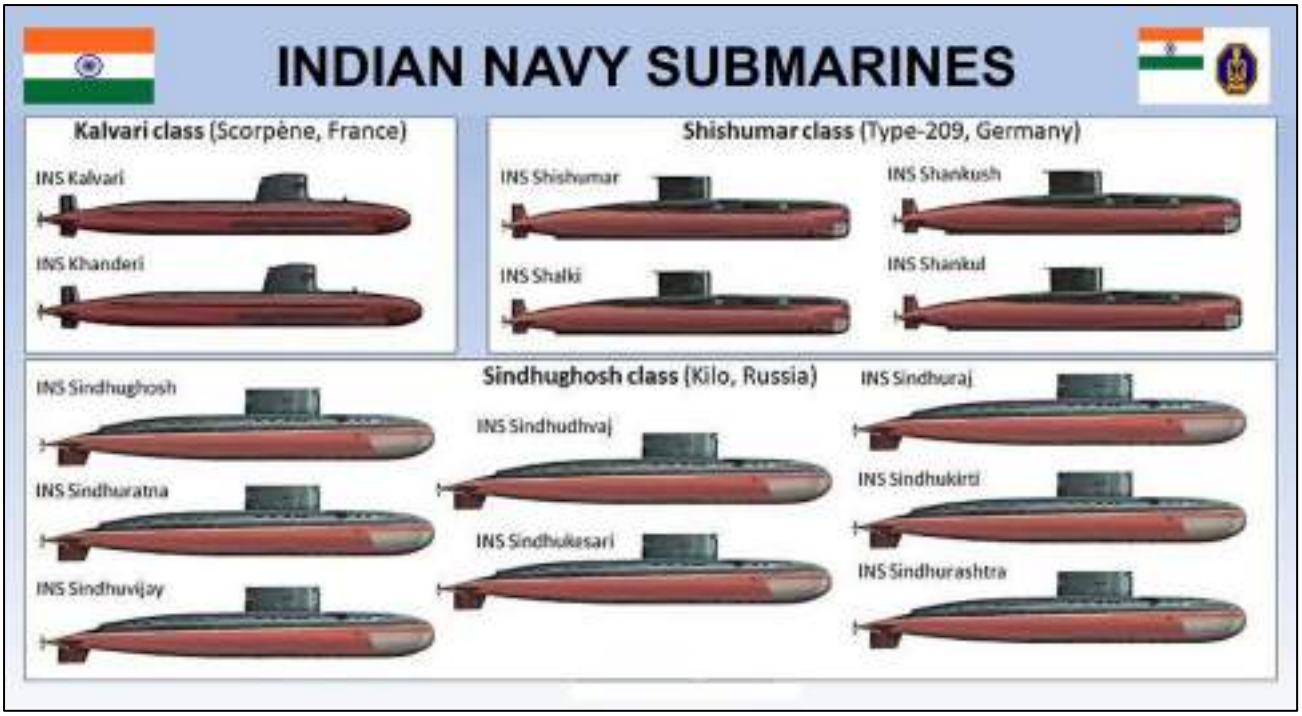
(k) **Intelligence Corps**. Responsible for providing military intelligence to support operations.

(l) **Pioneer Corps**. Provides crucial support in operational areas, including infrastructure development and maintenance, logistic assistance and security of vital installations.

PART II: INDIAN NAVY

11. Our nation has one of the largest peninsulas and has open water on three sides with a coastline of approximately 7500 km. As, it has been historically proven, the seas around our country have an impact/effect on our freedom, trade, commerce and culture The Indian Navy (Bhartiya Nau Sena), the maritime Branch of the Indian Armed Forces is the primary organization which ensures our maritime security. It is also supported by Indian Coast Guard which protects our maritime interests and enforces maritime laws. The Indian Navy today is a multidimensional force that has been organized to safe guard India's maritime territorial integrity and other maritime interests. It plays a crucial role in securing India's vast coastline, protecting maritime trade routes and ensuring the nation's maritime sovereignty. The Indian Navy also engages in humanitarian missions, disaster relief and international peacekeeping efforts.

12. The East India Company's Naval Arm came under the British Crown on 01 May 1830 and was later renamed as Her Majesty's Indian Navy in 1858. Thereafter, in 1892 Royal Indian Marine (RIM) was formed, handling marine surveys, lighthouse upkeep and troop transport during World War I. After the war, its strength was reduced and on 02 Oct 1934, it became the Royal Indian Navy headquartered at Bombay (Mumbai). At the time of partition like other forces (Army & Air Force), the Navy was also divided as Royal Indian Navy and Pakistan Navy. Following India's republic status on 26 Jan 1950, the Navy dropped the "Royal" prefix and was renamed as Indian Navy (IN).



Type of Warship	Description	Examples
Aircraft Carriers	Large ships capable of carrying and launching aircraft.	INS Vikramaditya, INS Vikrant
Destroyers	Versatile warships with anti-air, anti-ship, and anti-submarine capabilities.	INS Kolkata, INS Visakhapatnam, INS Imphal
Frigates	Smaller than destroyers, with multi-role capabilities.	INS Shivalik, INS Nilgiri
Corvettes	Compact warships designed for coastal defense and patrol duties.	INS Kamorta, INS Kiltan
Submarines	Submersible vessels used for stealthy underwater operations.	INS Kalvari, INS Arihant
Patrol Vessels	Smaller craft used for patrolling, search and rescue, and other coastal missions.	INS Saryu, INS Sunayna
Mine Countermeasures Vessels	Designed for mine-clearing operations.	INS Nireekshak, INS Karwar
Landing Platform Docks	Amphibious assault ships for launching troops and equipment ashore.	INS Jalashwa, INS Shardul
Offshore Patrol Vessels	Used for patrolling and surveillance in offshore waters.	INS Vikram, INS Vajra
Research Vessels	Ships dedicated to scientific research and oceanographic studies.	INS Sagardhwani, INS Sindhughosh (research variant)
Training Ships	Used for training purposes and instruction of naval cadets.	INS Tarangini, INS Sudarshini

13. **Constituents and Organisation**. The Indian Navy has a vast strength of personnel and a large operational fleet consisting of aircraft carriers, amphibious transport dock, landing ship tanks, destroyers, frigates, nuclear-powered attack submarine, ballistic missile submarine, conventionally-powered attack submarines, corvettes, mine countermeasure vessel, patrol vessels, fleet tankers and various other auxiliary vessels.

14. **Organisation and Administration**. The Indian Navy is a multi-dimensional force organized to operate above, on and under the surface of the oceans. It is headed by the Chief of the Naval Staff (CNS), a four-star admiral, with its headquarters at New Delhi. The CNS is assisted by the Vice Chief of Naval Staff (VCNS), a Vice Admiral. The CNS also heads the Integrated Headquarters (IHQ) of the Ministry of Defence (Navy), based in New Delhi. The Deputy Chief of Naval Staff (DCNS), a Vice-Admiral, is a Principal Staff Officer (PSO), along with the Chief of Personnel (COP) and the Chief of Material (COM), both of whom are also Vice-Admirals. The Indian Navy operates two operational commands and one training command. Each command is headed by a Flag Officer Commanding-in-Chief (FOC-in-C) of the rank of Vice Admiral.

COMMAND	HEADQUARTER
Western Naval Command	Mumbai
Eastern Naval Command	Vishakhapatnam
Southern Naval Command	Kochi

15. Naval operations in the operational commands are carried out by fleets and flotillas. A **fleet** is a large formation of warships under one command, designed to conduct extensive naval operations. The Indian Navy has two main fleets:-

(a) **Western Fleet**. Based in Mumbai, it includes the Navy's largest and most powerful ships, responsible for operations in the Arabian Sea.

(b) **Eastern Fleet**. Based in Visakhapatnam, it operates in the Bay of Bengal and beyond, ensuring maritime security in the eastern waters.

16. **Flotillas**. A flotilla is a smaller formation of ships, typically consisting of a mix of different types of vessels. The Indian Navy has flotillas based in Mumbai, Visakhapatnam and Port Blair, which provide local naval defence and support fleet operations.

17. **Submarine Squadrons**. Operate from various bases, including Visakhapatnam and Mumbai.

INTERESTING FACTS

- Fleet Composition: The Indian Navy's fleet includes aircraft carriers, destroyers, frigates, corvettes, submarines, and various auxiliary vessels. As of 2024, the Navy operates two aircraft carriers, INS Vikramaditya and INS Vikrant, along with a range of other advanced

18. **Indian Naval Air Arm**. The air arm is a fighting arm of the Indian Navy which is tasked to provide an aircraft carrier-based strike capability, fleet air defence, maritime reconnaissance and anti-sub marine warfare. Some prominent fighter air crafts that Indian Navy operates includes MiG 29 K and HAWK. It also employs other air crafts including Cheetah, Chetak and SEA KING helicopters.

SKY KING

MiG - 29 K

19. **Naval Air Stations**. The Navy operates several air stations equipped with aircraft for reconnaissance, anti-submarine warfare and logistics support. Key air stations include INS Hansa at Goa and INS Dega at Visakhapatnam and INS Rajali at Arakkonam. The Indian Navy's organizational structure ensures it can effectively manage and deploy its resources to protect India's maritime interests and respond to various challenges and threats.

PART III: AIR FORCE

20. The Indian Air Force (IAF) is the aerial warfare branch of the Indian Armed Forces, tasked with securing Indian airspace and conducting aerial operations during armed conflicts. It was established on October 8, 1932, as Indian Air Force, which took part in many gallant air actions during World War II. The ward Rayal was added post World War II. After the word was removed on 26 January 1950. On 1st Apr 1954, Air Marshall Subroto Mukherjee, one of the founding members of the Royal Indian Air Force took over as the first Chief of the Air Staff of the Indian Air Force.

21. The primary mission of the Indian Air Force is to secure Indian air space both during peace and war. The IAF plays the crucial role of conducting aerial warfare during armed conflicts, conducting strategic bombing, destroying enemy air assets, engaging in reconnaissance missions and providing air support to ground and naval forces where and when required. Additionally, the IAF participates in humanitarian missions, disaster relief and international peacekeeping efforts.

22. The IAF is the world's fourth largest Air Force in terms of both personnel and aircrafts. The Indian Airforce comprises of undermentioned aircrafts, helicopters and the associated equipments with which they execute their tasks and responsibilities:-

(a) Fighter Aircrafts.
(b) Bombers.
(c) Transport aircrafts.
(d) Attack Helicopters.
(e) Transport Helicopters.

(f) Reconnaissance Assets (aircrafts, helicopters and drones)
(g) Missiles.
(h) Radars.
(j) UAV's.

Boeing C-17 Globemaster III

Rafale M Fighter

LCA Mk 1A

Sukhoi SU-30MKI

Constituents and Organisation

23. **Air Headquarters**. The IAF's Air Headquarters is in New Delhi and is commanded by the Chief of Air Staff (CAS), a four-star officer. The staff of Air Headquarters consists of three branches namely, Air Staff Branch, Administrative Branch and Maintenance Branch.

24. **Commands**. The organizational structure includes several key sub organisations including Operational Commands, Maintenance Command and Training Command. These seven commands are headed by an Air Officer Commanding-in-Chief (AOC-in-C) of the rank of Air Marshal. Out of these seven, first five are operational commands. They are discussed below:-

(a) **Western Air Command (WAC)**. Based in New Delhi, responsible for operations in the western sector.

(b) **Eastern Air Command (EAC)**. Based in Shillong, responsible for operations in the eastern sector.

(c) **Central Air Command (CAC)**. Based in Prayagraj, responsible for operations in the central sector.

(d) **Southern Air Command (SAC)**. Based in Thiruvananthapuram, responsible for operations in the southern sector.

(e) **South Western Air Command (SWAC)**. Based in Gandhinagar, responsible for operations in the southwestern sector.

(f) **Training Command**. Based in Bengaluru, responsible for training and education of IAF personnel.

(g) **Maintenance Command**. Based in Nagpur, responsible for the maintenance and logistics support of IAF equipment.

25. The equipment profile and the functional division at basic organisation level of IAF is as follows:-

(a) **Fleets and Squadrons**. The IAF's operational capabilities are organized into various fleets and squadrons

(b) **Fighter Squadrons**. Equipped with aircraft such as the Su-30MKI, Rafale, Tejas, MiG-29, Mirage 2000 and MiG-21, these squadrons are responsible for all types of air missions including bombing, ground attack, reconnaissance and close air space missions.

(c) **Transport Squadrons**. Operate aircrafts like the C-130J Super Hercules, C-17 Globemaster III and An-32, providing strategic and tactical airlift capabilities.

(d) **Helicopter Units**. Equipped with helicopters such as the CH-47 Chinook, Mi-17 and Apache AH-64E, these units perform a variety of roles including transport, search and rescue and close air support.

(e) **Specialized Units**. The IAF includes specialized units such as the Garud Commando Force which is an elite special forces unit trained for airborne operations, counterterrorism and special reconnaissance missions.

(f) **Air Defence Units**. Responsible for protecting Indian airspace from enemy aircraft and missiles using advanced radar and missile systems.

26. Some important missile systems with IAF are:-

SAMAR Air Defence System

(a) **SAMAR**. A short-range air defence system created by the IAF Maintenance Command. The SAMAR system uses repurposed Vympel R-73 and Vympel R-27 air-to-air missiles to target low-flying aircraft, helicopters and drones.

(b) **Spyder**. A surface-to-air missile system that can engage aircraft, helicopters, drones and other targets. The IAF operates one squadron of SPYDER and has ordered four more.

(c) **Rampage**. A supersonic missile with a range of over 190 miles and a payload of 150 kilograms of explosives. The Rampage missile can operate in all weather conditions and has GPS/INS navigation with anti-jamming capabilities.

27. **Training Institutions**. The IAF operates several training institutions to ensure the continuous development of its personnel, including the Air Force Academy in Dundigal and the Flying Training Establishment in Hakimpet.

Air Force Academy, Dundigal, Hyderabad

28. The Indian Air Force's organizational structure and diverse capabilities enable it to effectively protect India's airspace and contribute to national and international security.

CONCLUSION

29. The Indian Armed Forces, comprising of the Indian Army, Navy and Air Force, play a pivotal role in safeguarding the nation's sovereignty and territorial integrity. The responsibility for national defence rests with the Cabinet, discharged through the Ministry of Defence, while the President of India serves as the Supreme Commander of the Indian Armed Forces. The establishment of the Chief of Defence Staff (CDS) has further enhanced tri-service coordination and integration.

30. The Indian Army, the largest component, ensures national security and unity, defends against external aggression and internal threats and participates in humanitarian and UN peacekeeping missions. The Indian Navy, a multidimensional force, protects India's maritime interests and engages in humanitarian missions and disaster relief. The Indian Air Force secures Indian airspace, conducts aerial operations and participates in humanitarian missions and international peacekeeping efforts.

31. The structured organization of the Indian Armed Forces, with their respective commands and specialized units, ensures effective operational capabilities. The Indian Armed Forces commitment to excellence, discipline and patriotism continues to inspire and uphold the nation's security and sovereignty. Through their dedicated service, the Indian Armed Forces not only protect the nation but also contribute to global peace and stability.

SUMMARY

- **National Defence Responsibility**. Rest with the Cabinet, discharged through the Ministry of Defence (MoD).
- **Supreme Commander**. The President of India.
- **Main Constituents**. Indian Army, Indian Navy and Indian Air Force.
- **Chief of Defence Staff (CDS)**. Established to enhance tri-service effectiveness and coordination.
- **Indian Army**.
  - Largest component of the Indian Armed Forces.
  - Ensures national security, unity and peace.
  - Participates in humanitarian and UN peacekeeping missions.
  - Divided into six operational commands and one training command.
- **Indian Navy**.
  - Multidimensional force safeguarding maritime interests.
  - Engages in humanitarian missions and disaster relief.
  - Divided into three commands Western, Eastern and Southern.
  - Includes the Indian Navy Air Arm.
- **Indian Air Force**.
  - Secures Indian airspace and conducts aerial operations.
  - Participates in humanitarian missions and international peacekeeping efforts.
  - Divided into seven commands Western, Eastern, Central, Southern, South Western, Training and Maintenance.
  - Includes various fleets and squadrons for different operational capabilities.
- **Historical Context**.
  - **Indian Army**. Formed in 1895 as the British Indian Army.
  - **Indian Navy**. Modern form established on January 26, 1950.
  - **Indian Air Force**. Established on October 8, 1932, as the Royal Indian Air Force.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Who is the Supreme Commander of the Indian Armed Forces?

(a) Prime Minister
(b) President
(c) Chief of Defence Staff
(d) Defence Minister

Q2. When was the British Indian Army officially formed?

(a) April 1, 1895
(b) January 26, 1950
(c) October 8, 1932
(d) August 15, 1947

Q3. How many operational commands does the Indian Army have?

(a) Four (b) Five
(c) Six (d) Seven

Q4. Which of the following is NOT a command of the Indian Navy?

(a) Western Naval Command
(b) Eastern Naval Command
(c) Northern Naval Command
(d) Southern Naval Command

Q5. Who was the first Chief of Defence Staff (CDS) of India?

(a) General Bipin Rawat
(b) General Sam Manekshaw
(c) Admiral Karambir Singh
(d) Air Chief Marshal Rakesh Kumar Singh Bhadauria

Q6. Which of the following is NOT a component of the Indian Army?

(a) Combat Arms
(b) Combat Support Arms
(c) Services
(d) Marine Corps

Q7. Which of the following arms is the backbone of Indian Army?

(a) Armoured Corps
(b) Corps of Signals
(c) Mechanised Infantry
(d) Infantry

Q8. Which of the following branches of the Indian Army is responsible for engineering support, including construction, demolition and maintenance of infrastructure?

(a) Army Service Corps
(b) Corps of Engineers
(c) Army Medical Corps
(d) Army Ordnance Corps

Q9. Who was the first Chief of the Air Staff of the Indian Air Force after India's independence?

(a) Air Marshal Arjan Singh
(b) Air Marshal Subroto Mukherjee
(c) Air Marshal Om Prakash Mehra
(d) Air Marshal S.K. Kaul

Q10. Which aircraft is NOT part of the Indian Navy Air Arm?

(a) MIG 29 K
(b) HAWK
(c) SU-30MKI
(d) SEA KING

Q11. Where is the headquarters of the Indian Air Force's Western Air Command located?

(a) New Delhi
(b) Shillong
(c) Prayagraj
(d) Thiruvananthapuram

Q12. What is the main function of the Indian Air Force's Maintenance Command?

(a) Conducting aerial operations
(b) Training and education
(c) Maintenance and logistics support
(d) Maritime reconnaissance

Q13. Which of these two fleets does Indian Navy has?

(a) Western and Eastern Fleet
(b) Northern and Southern Fleet
(c) South-western and Eastern Fleet
(d) Northern and Central Fleet

Q14. Which type of warship in the Indian Navy is designed for coastal defence and patrol duties?

(a) Aircraft Carriers (b) Destroyers
(c) Frigates (d) Corvettes

Q15. Which missile system used by the Indian Air Force (IAF) is designed to target low-flying aircraft, helicopters and drones using repurposed Vympel R-73 and Vympel R-27 air-to-air missiles?

(a) SAMAR
(b) SPYDER
(c) Rampage
(d) BrahMos

Short Answer Type Questions

Q1. What are the three main constituents of the Indian Armed Forces?

Q2. Describe the role of the Chief of Defence Staff (CDS) in the Indian Armed Forces.

Q3. What is the primary mission of the Indian Air Force?

Q4. Name the three commands of the Indian Navy and their respective headquarters.

Q5. What is the significance of Services in the Indian Army?

Long Answer Type Questions

Q1. Discuss the historical evolution of the Indian Army from the British Indian Army to its current form.

Q2. Explain the organizational structure and key functions of the Indian Navy.

Q3. Describe the various components and operational capabilities of the Indian Air Force.

Q4. How does the Ministry of Defence (MoD) support the Indian Armed Forces in discharging their responsibilities?

Q5. Analyse the importance Combat Arms and Combat Supporting arms in Indian Army?

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF II: BADGES OF RANKS OF INDIAN ARMED FORCES

"Rank does not confer privilege or give power. It imposes responsibility."

TEACHING INSTRUCTIONS

Period : 01 (40 Mins)
Type : Lecture
Year : 1st Year SD/SW
Conducting Officer : Permanent Instructor

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 05 Mins**
- **Part I : 10 Mins**
- **Part II : 10 Mins**
- **Part III : 10 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. The military rank structure is a fundamental aspect of the Indian Armed Forces, providing a clear hierarchy and chain of command. Ranks are not just titles, they signify the level of responsibility, authority and duty assigned to personnel. Unlike posts, titles or designations, ranks are permanent and remain with the individual even after retirement. This permanence underscores the lifelong commitment and honour associated with military service.

2. One of the most recognizable symbols of rank is the badge worn on the shoulders or sleeves. These badges serve multiple purposes, they identify the rank of the individual, facilitate the chain of command and symbolize the wearer's achievements and responsibilities. The tradition of wearing badges on the shoulder dates back to historical military practices, where visibility and quick identification were crucial in the chaos of battle.

3. In this chapter, we will explore the badges of rank across the Army, Navy and Air Force, examining their structure and significance. We will also compare the equivalent ranks among these branches and delve into the distinctions between these ranks which are prevalent in all three forces as well as their equivalence.

PIPPING OF A YOUNG ARMY OFFICER ON COMMISSIONING

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I: The Indian Army**.
- **Part II: The Indian Navy**.
- **Part III: The Indian Air Force**.

LEARNING OBJECTIVES

- **Learn about Indian Armed Forces – Army, Navy & Air Force**.
- **The constituents, organization, key elements and role of Indian Armed Forces**.
- **Familiarisation with combat arms, combat support arms and supporting services of Indian Army**.

PART I: BADGES OF RANKS -ARMY, NAVY AND AIR FORCE

4. **Indian Army**. Presently, the ranks and hierarchy in the Indian Army (IA) are categorised into three distinct categories given as below:-

(a) **Commissioned Officer**. Indian Army officers are directly commissioned by the President of India and are the leaders of the Indian Army. They are trained at prestigious institutions like the Indian Military Academy (IMA), the Officers Training Academy (OTA) and National Defence Academy (NDA). They go through various entrance exams conducted by UPSC like NDA Exam, CDS Exam followed by SSB interview to get selected. They hold ranks from Lieutenant to General and are responsible for strategic planning, leadership and decision-making at various levels. The rank of a Field Marshal is the highest rank of an officer of the Indian Army. It is an honorary rank and is reserved for significant contributions by an Army officer.

BADGES OF RANK OF OFFICERS OF INDIAN ARMY

(b) **Junior Commissioned Officer (JCO)**. They are equivalent to Group 'B' gazetted officers. They serve as a vital link between the officers and the enlisted soldiers. They are promoted from the ranks of Non-Commissioned Officers (NCOs) and hold ranks such as Subedar Major, Subedar and Naib Subedar. JCOs play a crucial role in maintaining discipline, executing orders and ensuring the smooth functioning of their units. They receive their commission from the President of India.

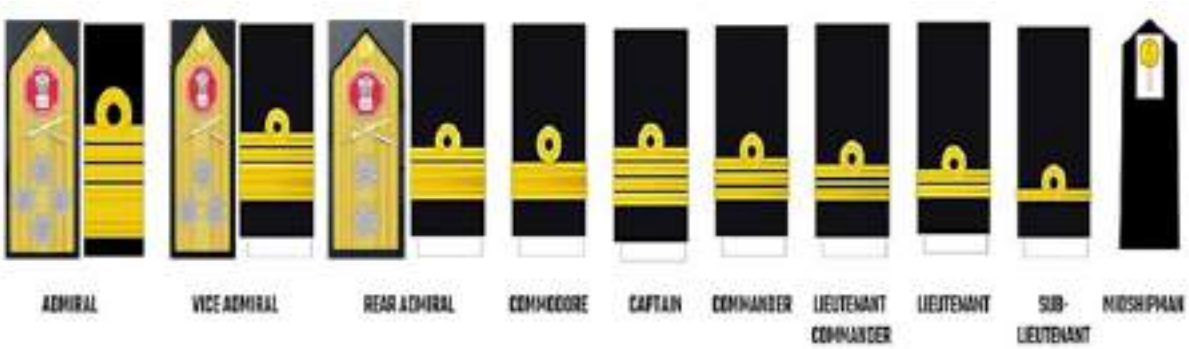
BADGES OF RANK OF JCOs AND NCOs OF INDIAN ARMY

(c) **Non Commissioned Officer (NCO)**. NCOs are the backbone of the Indian Army, responsible for executing orders and maintaining discipline. They are promoted from the ranks of enlisted soldiers and hold ranks like Havildar, Naik and Lance Naik. NCOs are essential for the day-to-day operations and management of their units, ensuring that tasks are carried out efficiently and effectively.

5. **Indian Navy (IN)**. Presently, the IN's rank hierarchy is divided into two broad categories:-

(a) **Commissioned Officers of Indian Navy**. The Indian Navy Officers go through the same selections as mentioned above. From the prestigious rank of Admiral (Chief of Naval Staff) representing the topmost post of naval excellence, to the starting post of Midshipman, each level holds a unique significance in the complexities of the Indian Navy's structure. The Naval Officers of IN holds ranks for Sub Lieutenant to Admiral and are responsible for strategic planning, leadership and decision making at various levels. The rank of an Admiral of the Fleet, the highest-ranking officer of the Indian Navy with a five-star honorary rank and is reserved for significant contributions by a naval officer.

BADGES OF RANK OF OFFICERS OF INDIAN NAVY



(b) **Sailors of the Indian Navy**. Sailors of the Indian Navy are divided into two categories:-

(i) **Senior Sailors**. Petty Officer, Chief Petty Officer, Master Chief Petty Officer (First Class & Second Class).

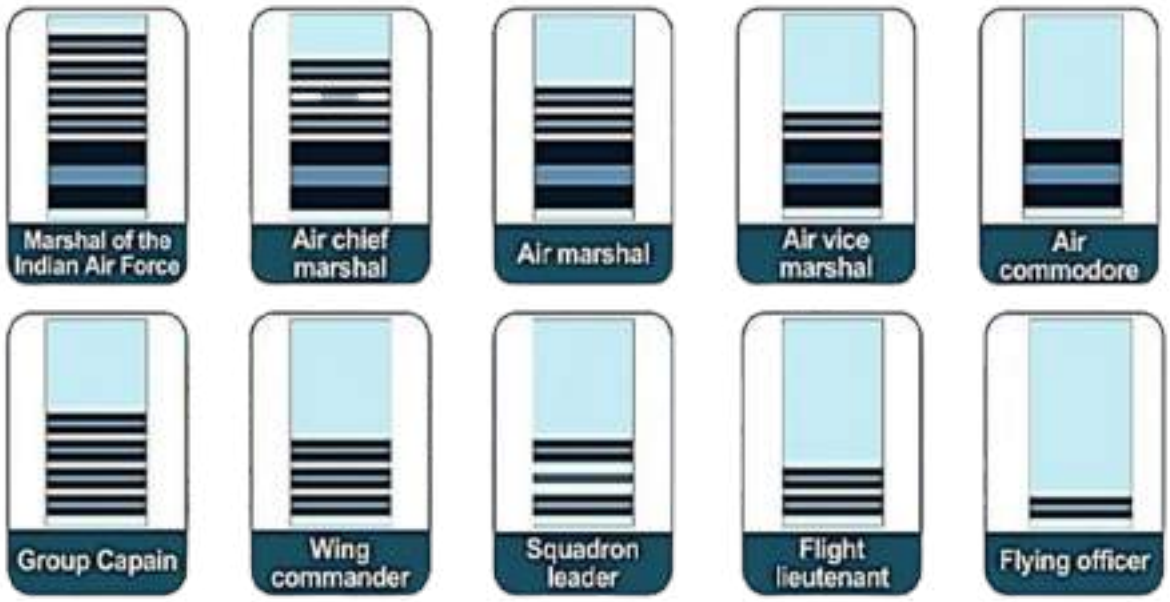
(ii) **Junior Sailors**. Leading Seaman, Sea-I and Sea -II.

BADGES OF RANK OF SAILORS OF INDIAN NAVY

6. **Indian Air Force**. The cadre of the same rank are addressed differently in Navy vis-à- vis the Army. Similarly, the ranks of personnel viz officers, JCOs and NCOs are addressed differently in IAF also. Commissioned Officers lead and manage the forces and they have corresponding ranks in each branch. The Air Force ranks include Marshal of the Indian Air Force (honorary for exceptional contributions), Air Chief Marshal, Air Marshal, Air Vice

Marshal, Air Commodore, Group Captain, Wing Commander, Squadron Leader, Flight Lieutenant and Flying Officer. Indian Air Force aircrafts are piloted by officers only.

BADGES OF RANK OF OFFICERS OF INDIAN AIR FORCE



7. The Air Force's JCOs encompass Warrant Officers and Junior Warrant Officers, while NCO/Other Ranks include Sergeants, Corporals, Leading Aircraftsmen and Aircraftsmen.

BADGES OF RANK OF WARRANT OFFICERS AND NCOs OF INDIAN AIR FORCE

8. The NCOs and Airmen are involved in all activities of an air base and give support to various technical and non-technical jobs. While, the JCOs manage and supervise the NCOs and Airmen, the officers on the other hand apart from flying all military aircrafts are involved in strategic planning, management and higher level of technical guidance and providing navigation with respect to all aspects of aerial warfare.

INTERESTING FACTS

- Till date only IA and IAF Officers have been given the honorary rank of Field Marshal or equivalent. These are Field Marshal KM Cariappa and Field Marshal SHFJ Manekshaw from Army and Marshal of the Air Force Arjan Singh from Air Force.
- Since 1950, the designation of Chief Petty Officer was the highest non-commissioned rank in IN's rank hierarchy until December 1968, when the designations of Master Chief Petty Officer I and Master Chief Petty Officer II were introduced.

PART II: EQUIVALENT RANKS IN ARMY, NAVY AND AIR FORCE

9. The structured ranks within the Indian Army, Navy and Air Force are an embodiment of the military's order and organization. They represent the dedication and commitment of the personnel who safeguard the country's borders and interests, working together to uphold national security. Understanding equivalent ranks across these branches is crucial for effective communication and cooperation. Let us understand the corresponding ranks in the Indian Army, Navy and Air Force with the help of this table:-

ARMY	NAVY	AIRFORCE
Field Marshal	**Admiral of the Fleet**	**Marshal of the Air Force**
General	**Admiral**	**Air Chief Marshal**
Lt General	**Vice Admiral**	**Air Marshal**
Major General	**Rear Admiral**	**Air Vice Marshal**
Brigadier	**Commodore**	**Air Commodore**
Colonel	**Captain**	**Group Captain**
Lt Colonel	**Commander**	**Wing Commander**
Major	**Lt Commander**	**Squadron Leader**
Captain	**Lieutenant**	**Flight Lieutenant**
Lieutenant	**Sub Lieutenant**	**Flying Officer**

JCOs AND NCOs OF INDIAN ARMED FORCES

Army	Navy	Air Force
Sub Major	**MCPO I**	**Master Warrant Officer**
Subedar	**MCPO II**	**Warrant Officer**
Naib Subedar	**Chief Petty Officer**	**Junior Warrant Officer**
Havildar	**Petty Officer**	**Sergeant**
Naik	**Leading Seaman**	**Corporal**
Lance Naik	**Sea I**	**Leading Aircraftsman**
Sepoy	**Sea II**	**Aircraftman**

PART III: SYMBOLISM OF BADGES OF RANK

10. The design of military badges is steeped in symbolism. Each element, from the colour to the shape, carries specific meanings:

(a) **Stars**. Often used to denote higher ranks, stars symbolize excellence and leadership. The number of stars typically indicates the level of seniority.

(b) **Stripes**. Stripes are commonly used to represent different levels of rank, especially among non-commissioned officers.

(c) **National Emblems**. Many badges incorporate national symbols, such as the Ashoka Chakra in India, to signify the wearer’s allegiance and service to their country.

(d) **Crossed Swords/Batons**. These symbols often represent command and authority.

11. **Colours**. The use of gold, silver and other colours can denote different branches of the military or levels of rank. Gold is often associated with higher ranks and command positions. By understanding these elements, one can appreciate the depth of meaning and tradition embodied in each badge of rank.

CONCLUSION

12. In conclusion, the badges of rank in the Army, Navy and Air Force are more than just symbols of hierarchy. They represent the honour, responsibility and commitment of military personnel. These badges facilitate the chain of command, ensuring clarity and order within the Indian Armed Forces. Understanding the rank structure and the significance of these badges provides insight into the organization and functioning of the military, highlighting the dedication and service of its members.

SUMMARY

- Ranks signify authority, responsibility and duty within the Indian Armed Forces.
- They remain with personnel even after retirement, reflecting lifelong honour and commitment.
- **Badges of Rank**.
  - **Army**. Badges range from Field Marshal (crossed batons and crown) to Lieutenant (Two stars).
  - **Navy**. Badges range from Admiral of the Fleet (crossed batons and crown) to Sub-Lieutenant (one gold stripe).
  - **Air Force**. Badges range from Marshal of the Air Force (five stars) to Flying Officer (one stripe).
- Understanding equivalent ranks across the Army, Navy and Air Force helps in recognizing the hierarchy and responsibilities in each branch.
- **Commissioned Officers**. Senior ranks with significant command responsibilities.
- **Junior Commissioned Officers (JCOs)**. Intermediate ranks bridging the gap between officers and enlisted personnel.
- **Non-Commissioned Officers (NCOs)**. Essential for maintaining discipline and executing orders at the ground level.

This summary should help cadets quickly recall the essential points from the chapter.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Which of the following is NOT true about military ranks?

(a) Ranks signify the level of responsibility, authority and duty assigned to personnel.
(b) Ranks are temporary and change frequently based on assignments.
(c) Ranks are permanent and remain with the individual even after retirement.
(d) Badges worn on the shoulders or sleeves symbolize the wearer's achievements and responsibilities.

Q2. Which rank in the Indian Army is denoted by crossed batons surrounded by a wreath beneath a crown?

(a) General
(b) Field Marshal
(c) Lieutenant General
(d) Major General

Q3. Which of the following ranks are NOT held by Junior Commissioned Officers (JCO) in the Indian Army?

(a) Subedar Major
(b) Naib Subedar
(c) Lance Naik
(d) None of the above

Q4. What is the badge for a Vice Admiral in the Indian Navy?

(a) Four gold stripes
(b) A broad gold stripe with three narrower stripes
(c) A broad gold stripe with two narrower stripes
(d) A broad gold stripe with one narrower stripe

Q5. Which rank was the highest non-commissioned rank in the Indian Navy until December 1968?

(a) Master Chief Petty Officer I
(b) Master Chief Petty Officer II
(c) Chief Petty Officer
(d) Leading Seaman

Q6. What does the badge of a Subedar Major in the Indian Army look like?

(a) Three five-pointed stars in a triangular formation
(b) Crossed sword and baton beneath a five-pointed star
(c) National emblem with a star
(d) National emblem

Q7. Which rank in the Indian Navy is denoted by one gold stripe?

(a) Sub Lieutenant (b) Lieutenant
(c) Midshipman (d) Lieutenant Commander

Q8. Which of the following is the lowest rank in the Indian Air Force?

(a) Corporal
(b) Sergeant
(c) Leading Aircraftsman
(d) Air Craftsman

Q9. What is the equivalent rank of a Squadron Leader in the Indian Navy?

(a) Lieutenant Commander
(b) Commander
(c) Captain
(d) Commodore

Q10. What is the equivalent rank of a ‘Havildar’ in the Indian Navy?

(a) Petty Officer
(b) Able Seaman
(c) Leading Seaman
(d) Chief Petty Officer

Q11. Which rank in the Indian Air Force is equivalent to ‘Subedar Major’ in the Indian Army?

(a) Junior Warrant Officer
(b) Master Warrant Officer
(c) Master Chief Petty Officer I
(d) Air Marshal

Q12. Which rank in the Indian Air Force is represented by two and a half stripes?

(a) Flight Lieutenant (b) Squadron Leader
(c) Wing Commander (d) Group Captain

Q13. Which rank in the Indian Army is represented by two stars?

(a) Captain (b) Lieutenant Colonel
(c) Colonel (d) Lieutenant

Q14. What is the significance of stars in military badges?

(a) Indicate different branches of the military
(b) Represent higher ranks and leadership
(c) Symbolize national allegiance
(d) Denote non-commissioned officers

Q15. Which symbol on military badges often represents command and authority?

(a) Stars
(b) Stripes
(c) National Emblems
(d) Crossed Swords/Batons

Short Answer Type Questions

Q1. Explain the significance of wearing badges on the shoulders in the military.

Q2. What is the badge for a Havildar in the Indian Army?

Q3. Describe the badge of a Commodore in the Indian Navy.

Q4. What rank in the Indian Air Force is represented by four stripes?

Q5. Why are ranks considered permanent in the military?

Long Answer Type Questions

Q1. Discuss the importance of military ranks and how they differ from posts, titles, or designations.

Q2. Compare the rank structures of the Indian Army, Navy and Air Force, highlighting the equivalent ranks among these branches.

Q3. Describe the badges of rank for commissioned officers in the Indian Army, Navy and Air Force.

Q4. Explain the roles and responsibilities of Junior Commissioned Officers (JCOs) and Non-Commissioned Officers (NCOs) in the Indian Armed Forces.

Q5. Analyse the significance of the symbols used in military badges, such as stars, stripes and national emblems.

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF III: HONOURS AND AWARDS OF INDIAN ARMED FORCES

"There is no honour greater than the honour of serving in the Indian Armed Forces."

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**2nd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

➢ **Introduction**	**:**	**05 Mins**
➢ **Part I**	**:**	**20 Mins**
➢ **Part II**	**:**	**10 Mins**
➢ **Conclusion**	**:**	**05 Mins**

INTRODUCTION

1. Honours and awards in the Indian Armed Forces are a significant means of recognizing and celebrating the bravery, dedication and exceptional service of military personnel. These accolades not only serve as a testament to the courage and commitment of the recipients but also inspire others to strive for excellence and selfless service.

2. The Indian Armed Forces have a structured system of honours and awards to ensure that acts of gallantry, distinguished service and exceptional contributions are appropriately recognized. These awards are categorized based on the nature of the act and the context in which it was performed, ensuring that each act of bravery or service is celebrated in a manner befitting its significance.

3. In this chapter, we will explore the various categories of gallantry awards, distinguished service awards and Commendation Cards, along with specific awards relevant to the National Cadet Corps (NCC).

Havildar Sanjay Kumar receiving Param Vir Chakra from the then Honourable President of India Sh KR Narayanan

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I: Gallantry Awards**.
- **Part II: NCC Specific Awards**.

LEARNING OBJECTIVES

- **To acquaint with all three categories of honours and awards given to Indian Defence Force Personnel**.
- **To familiarise with NCC specific awards**.
- **Interesting facts about most important gallantry awards and awardees**.

PART I: GALLANTRY AWARDS IN INDIAN ARMED FORCES

4. Gallantry awards are presented to individuals who display exceptional bravery and courage, often in life-threatening situations. These awards are categorized based on the context in which the act of gallantry was performed. Here are the main categories:-

5. **Category 1: Gallantry in the Face of the Enemy (Wartime)**. This category includes awards given for acts of bravery during armed conflict. The most prestigious awards in this category are:

(a) **Param Vir Chakra**. India's highest military decoration awarded for the highest degree of valour or self-sacrifice in the face of the enemy.

(b) **Maha Vir Chakra**. The second-highest military decoration in India, awarded for acts of conspicuous gallantry in the face of the enemy.

(c) **Vir Chakra**. The third-highest military decoration in India, awarded for acts of gallantry in the face of the enemy.

6. **Category 2: Gallantry Other Than in the Face of the Enemy (Peacetime)**. This category includes awards for acts of bravery that occur outside of combat situations. These awards recognize the courage displayed in situations such as natural disasters, rescue operations, counter insurgency operations, low intensity conflict and other life-threatening scenarios. Key awards in this category include:-

(a) **Ashoka Chakra**. India's highest peacetime military decoration awarded for valour, courageous action or self-sacrifice away from the battlefield.

(b) **Kirti Chakra**. The second-highest peacetime military decoration in India, awarded for valour, courageous action or self-sacrifice away from the battlefield.

(c) **Shaurya Chakra**. The third-highest peacetime military decoration in India, awarded for valour, courageous action or self-sacrifice away from the battlefield.

7. **Category 3: Distinguished Service Awards**. These awards are given for distinguished service and exceptional performance in duties. They recognize the dedication and commitment of individuals in their professional roles. Some notable awards in this category are:-

(a) **Param Vishisht Seva Medal**. Awarded for distinguished service of the most exceptional order.

(b) **Ati Vishisht Seva Medal**. Awarded for distinguished service of an exceptional order.

(c) **Vishisht Seva Medal**. Awarded for distinguished service of a high order.

Param Vishisht Seva Medal

Ati Vishisht Seva Medal

Vishisht Seva Medal

8. **Commendation Cards**. These are awarded to individuals for their meritorious service, acts of bravery or exceptional performance in their duties. These cards serve as a formal recognition of the recipient's contributions and achievements. The types of commendation cards and the authorities who award them is mentioned in succeeding paragraphs.

9. **Types of Commendation Cards**

(a) Army Commendation Card.

(b) Navy Commendation Card.

(c) Air Force Commendation Card.

10. **Who Awards Them**

(a) **Chief of Army Staff (COAS) Commendation Card**. Awarded by the Chief of Army Staff for acts of bravery or distinguished service.

(b) **Chief of Naval Staff (CNS) Commendation Card**. Awarded by the Chief of Naval Staff for exceptional service or acts of bravery.

(c) **Chief of Air Staff (CAS) Commendation Card**. Awarded by the Chief of Air Staff for meritorious service or acts of bravery.

11. These commendation cards are highly regarded and serve as a testimony to the recipient's dedication and excellence in their respective fields.

CHIEF OF ARMY STAFF COMMENDATION CARD

CHIEF OF NAVAL STAFF COMMENDATION CARD

CHIEF OF AIR STAFF COMMENDATION CARD

12. **Importance of Honour and Awards in Indian Armed Forces**. Honour and awards in the Army, Navy and Air Force play a crucial role in recognizing and celebrating the bravery, dedication and exceptional service of military personnel. They serve as a powerful motivator, fostering a culture of excellence and commitment; and enhancing the morale and esprit de corps within the Indian Armed Forces.

13. **Recognition and Ceremony**. Recognition and ceremonies for honour and awards provide a formal platform to publicly acknowledge the achievements of military personnel. These events not only highlight the standards of excellence and bravery but also inspire others to strive for similar accomplishments, reinforcing the values and traditions of the Indian Armed Forces. The President of India awards gallantry and distinguished service awards in ceremonies held at Rastrapati Bhawan twice a year. The presence of very senior government officials, military leaders and dignitaries, adds to the prestige and significance of these awards.

DID YOU KNOW?

- Param Vir Chakra (PVC) is the highest award of bravery given to Indian Armed Forces Personnel for gallant life-threatening actions or gallant actions in which supreme sacrifice is made by a soldier in the face of enemy. The PVC is equivalent to Victoria Cross in the United Kingdom and the Medal of Honour in the United States. Maj Somnath Sharma was awarded the first PVC. As on date 21 PVCs have been awarded.
- In India, post-independence new award system was instituted on 26 Jun 1950, with retrospective effect from 15 Aug 1947 which was similar to those in vogue in British and American Defence Forces.

PARAM VIR CHAKRA AWARDEES

MAJOR SOMNATH SHARMA
(Posthumous),
4 KUMAON (1947)

LANCE NAIK KARAM SINGH
1 SIKH (1948)

2ND LT. RAMA RAGHOBA RANE
BOMBAY ENGINEER (1948)

NAYAK JADUNATH SINGH
(Posthumous),
1 RAJPUT (1948)

CHM PIRU SINGH
(Posthumous),
6 RAJ RIF (1948)

CAPT GS SALARIA
(Posthumous),
3/1 GR (1961)

MAJOR DHAN SINGH THAPA
1/8 GR (1962)

SUBEDAR JOGINDER SINGH
(Posthumous),
1 SIKH (1962)

MAJOR SHAITAN SINGH
(Posthumous)
13 KUMAON (1962)

CQMH. ABDUL HAMID
(Posthumous),
4GRENADIERS (1965)

LT COL AB TARAPORE
(Posthumous),
17 HORSE (1965)

LANCE NAIK ALBERT EKKA
(Posthumous)
14 GUARDS (1971)

MAJOR HOSHIAR SINGH
3 GRENADIERS
(1971)

2ND LT ARUN KHETARPAL
(Posthumous)
17 HORSE (1971)

FLYING OFFICER NIRMALJIT SINGH SEKHON
(Posthumous) NO.18
SQUADRON(1971)

MAJOR R PARAMESWARAN
(Posthumous),
8 MAHAR (1987)

NAIB SUBEDAR BANA SINGH
8 JAK LI (1987)

CAPT VIKRAM BATRA
(Posthumous),
13 JAK RIF (1999)

LT MANOJ KUMAR PANDEY
(Posthumous),
1/11 GR (1999)

GRENADIER YOGENDER SINGH YADAV
18 GRENADIERS (1999)

SUBEDAR MAJOR (THEN RIFLEMAN) SANJAY KUMAR
13 JAK RIF (1999)

DID YOU KNOW?

- Honorable PM, labelled 21 largest Islands of Andaman and Nicobar Islands on the name of **Param Vir Chakra Awardees** (PVC) on the occasion of Parakram Diwas (**Birthday of Netaji Subhash Chandra Bose**) on 23 Jan 2023.

14. The Ashoka Chakra is India's highest peacetime military decoration awarded for valour, courageous action or self-sacrifice away from the battlefield. It is the peacetime equivalent of the Param Vir Chakra (PVC) and is awarded for the 'most conspicuous bravery or some daring or pre-eminent valour or self-sacrifice' other than in the face of the enemy.

DID YOU KNOW?

- As of August 2025, the Ashoka Chakra has been awarded to 86 awardees, of which 68 were to posthumous recipients. Some of them are Corporal Jyoti Prakash (2018), Major Mukund Varadarajan (2014), Col Jojan Thomas (2009), Sub Sujjan Singh Yadav (1995), Wing Commander Rakesh Sharma (1985) and Nk Narbahadur Thapa (1952).

PART II: NCC SPECIFIC AWARDS

15. NCC specific awards are designed to recognize the exceptional contributions and achievements of cadets and officers within the National Cadet Corps. Here are the details of the key awards:

(a) **Governor's Medal**. The Governor's Medal is awarded to NCC cadets for their exemplary performance and contribution at the state level. This medal is a prestigious recognition of the cadet's dedication, leadership and service to the NCC and the community.

(b) **Raksha Mantri Medal**. The Raksha Mantri Medal is awarded for outstanding performance at the national level. This medal is given to cadets who have demonstrated exceptional courage, dedication and service, significantly contributing to the NCC's mission and objectives.

(c) **Raksha Mantri Commendation Card**. The Raksha Mantri Commendation Card is awarded for acts of outstanding courage or devotion to duty that enhance the image of the NCC. This commendation is given to whole-time and part-time NCC officers, UOIs (Under Officer Instructors), SMIs (Senior Military Instructors) and NCC cadets. The commendation recognizes acts that involve significant bravery or exceptional service.

(d) **Defence Secretary Commendation Card**. The Defence Secretary Commendation Card is awarded for notable acts or deeds in the fields of adventure, sports, training, or outstanding contributions in social or cultural activities. This commendation is given to whole-time and part-time NCC officers, UOIs, SMIs and NCC cadets. The commendation highlights the recipient's significant contributions to the NCC and the community.

DG NCC Commendation Card. The Director General NCC Commendation Card is awarded to recognize outstanding and distinguished service rendered by Civilian Employees, NCC officers, ANOs, GCIs and cadets. This commendation is given for dedication and devotion to work, efficient management of NCC activities and significant contributions to the NCC's mission.

Director General's commendation card being presented to the Cadet Tsewang Dolma for her outstanding performance during the summit of Mt. Kang Yatse

16. **Best Cadet Award**. The Best Cadet Award is one of the most prestigious recognitions within the National Cadet Corps (NCC). This award is given to cadets who have demonstrated exceptional performance, leadership and dedication across various activities and training programs. The Best Cadet Award is presented at various levels within the NCC:-

(a) **Unit Level**. Awarded to the best cadet within an NCC unit.

(b) **Group Level**. Awarded to the best cadet within an NCC group, which comprises several units.

(c) **Directorate Level**. Awarded to the best cadet within an NCC directorate, which covers a larger geographical area.

(d) **National Level**. The highest level, awarded to the best cadet in the country. This award is often presented during the Republic Day Camp (RDC) in New Delhi.

17. The Best Cadet Award not only acknowledges the cadet's hard work and dedication but also serves as an inspiration for other cadets to strive for excellence in their NCC activities. These awards play a crucial role in motivating NCC cadets and officers to strive for excellence and uphold the values of discipline, leadership and patriotism.

CONCLUSION

18. Honours and awards in the Indian Armed Forces are more than just symbols of recognition; they are a testament to the bravery, dedication and exceptional service of military personnel. These accolades serve to inspire others within the Indian Armed Forces and the

National Cadet Corps (NCC) to strive for excellence and selfless service. The structured system of honours and awards ensures that acts of gallantry, distinguished service and exceptional contributions are appropriately recognized, fostering a culture of valour and dedication.

19. Gallantry awards, whether in the face of the enemy or during peacetime, highlight the courage and self-sacrifice of individuals who go above and beyond the call of duty. Distinguished service awards recognize the exceptional performance and dedication of military personnel in their professional roles. Commendation cards, awarded by the Chiefs of Army, Navy and Air Staff, as well as specific awards for NCC cadets and officers, further emphasize the importance of recognizing meritorious service and acts of bravery.

20. NCC specific awards, such as the Governor's Medal, Raksha Mantri Medal, DGNCC Commendation Card and the Best Cadet Award, play a crucial role in motivating cadets to uphold the values of discipline, leadership and patriotism. These awards not only acknowledge the hard work and dedication of the recipients but also serve as an inspiration for others to strive for excellence in their NCC activities.

21. In conclusion, the honours and awards system in the Indian Armed Forces and the NCC is integral to maintaining high standards of service and fostering a culture of excellence. By recognizing and celebrating the achievements of military personnel and cadets, these awards contribute to the overall mission of the Indian Armed Forces and the NCC, ensuring that the values of bravery, dedication and exceptional service continue to be upheld.

SUMMARY

- Honours and awards in the Indian Armed Forces recognize and celebrate the bravery, dedication and exceptional service of military personnel. These accolades inspire others to strive for excellence and selfless service.
- **Gallantry in the Face of the Enemy (Wartime)**:
  - Param Vir Chakra. Highest military decoration for valour or self-sacrifice in the presence of the enemy.
  - Maha Vir Chakra. Second-highest military decoration for conspicuous gallantry in the presence of the enemy.
  - Vir Chakra. Third-highest military decoration for gallantry in the presence of the enemy.
- **Gallantry Other Than in the Face of the Enemy (Peacetime)**:
  - Ashoka Chakra. Highest peacetime military decoration
  - Kirti Chakra. Second-highest peacetime military decoration
  - Shaurya Chakra. Third-highest peacetime military decoration
- **Distinguished Service Awards**:
  - Param Vishisht Seva Medal, Ati Vishisht Seva Medal and Vishisht Seva Medal

- **Commendation Cards**:
  - Types. Army, Navy and Air Force Commendation Cards.
  - Awarded by. Chief of Army Staff, Chief of Naval Staff and Chief of Air Staff for acts of bravery, distinguished service, or meritorious service.
- **NCC Specific Awards**:
  - Governor's Medal. Awarded to NCC cadets for exemplary performance at the state level.
  - Raksha Mantri Medal. Awarded for outstanding performance at the national level.
  - Raksha Mantri Commendation Card. Recognizes acts of outstanding courage or devotion to duty.
  - Defence Secretary Commendation Card. Awarded for notable acts in adventure, sports, training, or social/cultural activities.
  - DG NCC Commendation Card. Recognizes outstanding service by civilian employees, NCC officers and cadets.
  - Best Cadet Award. Given at unit, group, directorate and national levels for exceptional performance, leadership and dedication.

These awards play a crucial role in motivating military personnel and NCC cadets to uphold the values of discipline, leadership and patriotism.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of honours and awards in the Indian Armed Forces?

(a) To provide financial incentives
(b) To recognize and celebrate the bravery, dedication and exceptional service of military personnel
(c) To increase the number of recruits
(d) To promote political agendas

Q2. Which is the highest military decoration awarded for valour in the presence of the enemy?

(a) Maha Vir Chakra
(b) Param Vir Chakra
(c) Vir Chakra
(d) Ashoka Chakra

Q3. The Ashoka Chakra is awarded for acts of bravery during:-

(a) War time
(b) Peace time
(c) Both war and peace time
(d) None of the above

Q4. Which award is given for distinguished service of the most exceptional order?

(a) Param Vishisht Seva Medal
(b) Ati Vishisht Seva Medal
(c) Vishisht Seva Medal
(d) Shaurya Chakra

Q5. The Raksha Mantri Medal is awarded for:-

(a) State level performance
(b) National level performance
(c) Acts of bravery in combat
(d) Distinguished service

Q6. Who awards the Chief of Naval Staff (CNS) Commendation Card?

(a) Chief of Army Staff
(b) Chief of Air Staff
(c) Chief of Naval Staff
(d) Defence Secretary

Q7. Which officer led the team that wrested control of the highest peak on the Siachen Glacier as part of Operation Rajiv?

(a) Major Somnath Sharma
(b) Nb Sub Bana Singh
(c) Captain Gurbachan Singh Salaria
(d) Major Dhan Singh Thapa

Q8. Who is the only Indian Air Force officer to have been honoured with the Param Vir Chakra?

(a) Group Captain Varun Singh
(b) Wing Commander Abhinandan Varthaman
(c) Flying Officer Nirmal Jit Singh Sekhon
(d) Air Marshal Arjan Singh

Q9. Which of the following is a peacetime gallantry award?

(a) Param Vir Chakra
(b) Maha Vir Chakra
(c) Kirti Chakra
(d) Vir Chakra

Q10. How many recipients of the Ashoka Chakra were posthumous as of August 2021?

(a) 68
(b) 86
(c) 52
(d) 64

Q11. The Best Cadet Award is presented at which levels?

(a) Unit, Group, Directorate, National
(b) State, National, International
(c) Unit, State, National
(d) Group, National, International

Q12. The Defence Secretary Commendation Card is awarded for contributions in.

(a) Combat operations
(b) Adventure, sports, training, social/cultural activities
(c) National security
(d) International peace-keeping

Q13. What does the Director General NCC Commendation Card recognize?

(a) Academic achievements
(b) Outstanding and distinguished service to the NCC
(c) Military bravery in battle
(d) Sports accomplishments

Q14. Which medal is awarded for exemplary performance at the state level in the NCC?

(a) Raksha Mantri Medal
(b) Governor's Medal
(c) DG NCC Commendation Card
(d) Param Vishisht Seva Medal

Q15. The Shaurya Chakra is awarded for.

(a) Valour in the presence of the enemy
(b) Distinguished service
(c) Courageous action away from the battlefield
(d) Meritorious service

Short Answer Type Questions

Q1. What is the Param Vir Chakra awarded for?

Q2. Name the three highest peacetime gallantry awards.

Q3. Who awards the Chief of Air Staff (CAS) Commendation Card?

Q4. What is the purpose of the Best Cadet Award in the NCC?

Q5. Describe the significance of the Governor's Medal in the NCC.

Long Answer Questions

Q1. Explain the difference between gallantry awards given during wartime and peacetime. Provide examples of each.

Q2. Discuss the role and importance of distinguished service awards in the Indian Armed Forces.

Q3. Describe the importance of the Param Vir Chakra and Ashoka Chakra and provide the names of a few recipients/awardees.

Q4. What are the NCC-specific awards and how do they contribute to the motivation and recognition of cadets?

Q5. Analyse the impact of the honours and awards system on the morale and performance of Indian Armed Forces personnel and NCC cadets.

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF IV: CENTRAL ARMED POLICE FORCES (CAPF) AND STATE POLICE

“Blind belief in authority is the greatest enemy of truth.”

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**2nd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 03 Mins**
- **Part I : 12 Mins**
- **Part II : 06 Mins**
- **Part III : 06 Mins**
- **Part IV : 08 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. The Ministry of Home Affairs (MHA) is a central government ministry responsible for internal security, border management, centre-state relations, administration of union territories and disaster management. The MHA oversees Central Police Organisations CPOs including the Central Armed Police Forces (CAPF). Apart from the CPOs, since the 7th schedule of Constitution places 'police' and 'public' orders as state subjects, there is state police which operates in respective states. This means that the primary responsibility for maintaining law and order lies with the state governments. Each state in India, has its own police force, which operates under the jurisdiction of the state government. The administration and control of these forces are managed by the respective State's Home Department. However, the cadre controlling agency of the officer cadre of Police forces i.e. IPS is MHA. The cadre controlling agency of all personnel except IPS officers in case of state police is respective State Government.

INTERESTING FACTS

- **The term "Paramilitary Forces" was for previously CAPF, highlighting their role in assisting the military.**
- **CAPF personnel actively participated in disaster relief operations and assisting during natural calamities like flood & earthquakes.**

सत्यमेव जयते
Ministry of Home Affairs
Government of India

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I: Central Police Organizations (includes CAPF).**
- **Part II: Central Intelligence and Investigative Agencies.**
- **Part III: State Police of India.**
- **Part IV: Badges of Ranks.**

LEARNING OBJECTIVES

- **Difference between CPOs and State Police.**
- **Basic understanding of CAPF and other CPOs and State Police.**
- **Identification – Badges of Ranks.**

PART I: CENTRAL POLICE ORGANISATIONS

2. The Central Police Organisations (CPOs) include both armed and non-armed police organisations. The armed police organisations are known as the CAPF, while the non- armed organisations include agencies like the CBI, IB, NIA, NCRB etc. These non-armed organisations play crucial roles in intelligence gathering, crime investigation and maintaining internal security.

3. **Central Armed Police Forces (CAPF)**. The Central Armed Police Forces (CAPF) are a group of seven security forces under the Ministry of Home Affairs (MHA). These forces are tasked with maintaining internal security, protecting borders and combating terrorism. The CAPF includes:-

(a) **Assam Rifles (AR)**. Established in 1835, Assam Rifles is the oldest paramilitary force in India. It is primarily responsible for counter-insurgency operations in the Northeast and guarding the Indo-Myanmar border. The force also assists in maintaining law and order and conducting relief operations during natural calamities.

(b) **Central Reserve Police Force (CRPF)**. The CRPF, formed in 1939, is the largest paramilitary force in India. It handles internal security duties, counter-insurgency and anti-terrorism operations. The CRPF is also deployed for election duties and to assist state police forces in maintaining law and order.

(c) **Indo-Tibetan Border Police (ITBP)**. Raised in 1962, the ITBP is responsible for guarding the Indo-China border and performing high-altitude operations. The force is trained in mountaineering and skiing and is often deployed for disaster management and relief operations in the Himalayan region.

(d) **Sashastra Seema Bal (SSB)**. Formed in 1963, the SSB guards the Indo-Nepal and Indo-Bhutan borders. The force is also involved in counter-insurgency operations and assists in maintaining law and order in border areas.

(e) **Border Security Force (BSF)**. Formed in 1965, the BSF is tasked with guarding Indo-Pakistan and Indo-Bangladesh borders during peacetime and

preventing transnational crime. It is the largest border guarding force in the world. The BSF also plays a significant role in counter-insurgency and anti- terrorism operations.

(f) **Central Industrial Security Force (CISF)**. Established in 1969, the CISF provides security to critical infrastructure installations, including airports, seaports, nuclear power plants and industrial units. The CISF also offers consultancy services to private industries and other organizations within the Indian government.

(g) **National Security Guard (NSG)**. Established in 1984, the NSG is a specially trained elite organisation jointly manned by selected Indian Armed Forces personnel and CAPF personnel. It is the unit for counter-terrorism and hostage rescue missions. Known as the "Black Cats," the NSG is trained to handle high-risk operations and is often deployed during major terrorist attacks and hijackings.

4. Each force within the CAPF is led by a Director General, an officer from the Indian Police Service (IPS), except for the Assam Rifles, which is headed by a Lieutenant General from the Indian Army.

DID YOU KNOW?

- BSF has 194 Battalions which includes one Camel Contingent which is a specialized battalion-size Camelry Unit and has its roots in Bikaner Camel Corps.
- CRPF has 247 Battalions out of which COBRA (acronym for Commando Battalion for Resolute Action) is a special operation unit which is proficient is guerrilla tactics and jungle warfare.
- The recruited members are inducted into the NSG only after they complete the rigorous training course that lasts for 90 days.

Non-Armed Organisations

5. Now, let's move on to the non-armed organizations of CPOs. Here is the list of all notable agencies of CPOs. These agencies collectively contribute to maintaining law and order, enhancing police capabilities and ensuring effective crime management across the country.

(a) **Intelligence Bureau (IB)**. The IB, established in 1887, is India's internal intelligence agency. It is responsible for counter-intelligence, counter-terrorism and gathering intelligence on various security threats.

(b) **Central Bureau of Investigation (CBI)**. The CBI, formed in 1941, investigates high-profile crimes, corruption and economic offenses. It is India's premier investigative agency and operates under the jurisdiction of the MHA.

(c) **Directorate of Coordination of Police Wireless (DCPW)**. Established in 1946, the DCPW provides communication support to police and paramilitary forces. It ensures seamless communication during operations and emergencies.

(d) **Bureau of Police Research and Development (BPR&D)**. Established in 1970, the BPR&D focuses on the modernization of police forces and research in policing. It conducts studies on various aspects of policing and provides training to police personnel.

(e) **National Institute of Criminology and Forensic Science (NICFS)**. Established in 1972, the NICFS provides training and research in criminology and forensic science. It offers courses and conducts research to enhance the capabilities of law enforcement agencies. NICFS now integrated with the **National Forensic Sciences University (NFSU)**.

CENTRAL BUREAU OF INVESTIGATION

INTELLIGENCE BUREAU

(f) **National Crime Records Bureau (NCRB)**. Formed in 1986, the NCRB collects and analyses crime data to aid in policy formulation and law enforcement. It also maintains a national database of criminals and crime records.

(g) **National Disaster Response Force (NDRF)**. Established in 2006, the NDRF specializes in disaster response and relief operations. It is deployed during natural and man-made disasters to conduct rescue and relief operations.

(h) **National Investigation Agency (NIA)**. Formed in 2009, the NIA investigates and prosecutes offenses affecting national security. It handles cases related to terrorism, smuggling of arms and other serious crimes.

6. **Police Training Institutes**. These institutes are also part of Central Police Organisations (CPOs):-

(a) **Sardar Vallabhbhai Patel National Police Academy, Hyderabad (SVPNPA)**. The SVPNPA, established in 1948, trains Indian Police Service (IPS) officers. It offers various courses and training programs to enhance the skills and knowledge of police officers.

(b) **North Eastern Police Academy, Shillong (NEPA)**. Formed in 1978, NEPA trains police officers from the northeastern states. It provides training in various aspects of policing and law enforcement.

NORTH EASTERN POLICE ACADEMY (NEPA)

PART II: CENTRAL INTELLIGENCE AND INVESTIGATIVE AGENCIES

7. Several intelligence and investigative agencies under the Ministry of Finance and the Cabinet Secretariat also perform policing functions. These agencies are involved in collecting intelligence and investigating economic offenses related to customs, excise, income tax, foreign exchange, money laundering and narcotics smuggling. Usually, these agencies work in close coordination and synergy with the CPOs and State Police. Some of these important agencies include:-

(a) **Enforcement Directorate (ED)**. Established in 1956, the ED enforces economic laws and fights financial crimes. It investigates cases related to money laundering, foreign exchange violations and other financial offenses.

(b) **Directorate General of Revenue Intelligence (DGRI)**. Formed in 1957, the DGRI investigates smuggling and customs-related offenses. It plays a crucial role in preventing illegal trade and protecting the country's economic interests.

(c) **Directorate General of Income Tax (Investigation)**. Formed in 1964, this directorate investigates income tax- related offenses. It conducts searches, seizures and surveys to detect tax evasion.

(d) **Directorate General of Anti-Evasion (DGAE)**. Established in 1978, the DGAE investigates tax evasion. It works to prevent revenue loss and ensure compliance with tax laws.

(e) **Central Economic Intelligence Bureau (CEIB)**. Established in 1985, the CEIB collects intelligence on economic offenses. It coordinates with other agencies to combat economic crimes.

ENFORCEMENT DIRECTORATE

DIRECTORATE OF REVENUE

(f) **Narcotics Control Bureau (NCB)**. Established in 1986, the NCB combats drug trafficking and abuse. It coordinates with other agencies to prevent the smuggling and distribution of narcotics.

(g) **Financial Intelligence Unit (FIU-IND)**. Formed in 2004, the FIU-IND analyses financial transactions to combat money laundering and terrorist financing. It collects and disseminates information to law enforcement agencies.

(h) **National Technical Research Organisation (NTRO)**. Conducts technical intelligence gathering.

(j) **Research and Analysis Wing (RAW)**. India's external intelligence agency.

(k) **Aviation Research Centre (ARC)**. Aerial reconnaissance and intelligence gathering.

(l) **Special Protection Group (SPG)**. An agency of the Government of India whose sole responsibility is protecting the Prime Minister of India and, in some cases, his or her family.

8. **Railway Protection Force (RPF)**. The Railway Protection Force (RPF) functions under the control of the Ministry of Railways. It is responsible for protecting railway property, passengers and ensuring the safety of the railways.

NARCOTICS CONTROL BUREAU

RAILWAY PROTECTION FORCE

PART III: STATE POLICE

9. The State Police forces in India are responsible for maintaining law and order, preventing and investigating crimes and ensuring the safety of citizens within their respective states. Each state and union territory has its own police force, which operates under the jurisdiction of the state government. The structure and organization of state police forces are generally similar across the country, with some variations based on local needs and conditions.

10. Hierarchy structure of State Police:-

(a) **Director General of Police (DGP)**. The highest-ranking officer in a state police force, usually an IPS officer. The DGP oversees all police operations within the state and reports to the state government.

(b) **Additional Director General of Police (ADGP)**. Assists the DGP in managing the police force and may oversee specific departments or regions within the state.

(c) **Inspector General of Police (IGP)**. Manages police operations in a specific zone or range within the state. The IGP reports to the ADGP or DGP.

(d) **Deputy Inspector General of Police (DIG)**. Assists the IGP in managing police operations within their jurisdiction. The DIG oversees multiple districts or units.

(e) **Superintendent of Police (SP)**. Oversees police operations in a district. The SP is responsible for maintaining law and order, preventing crime and ensuring the safety of citizens.

(f) **Additional Superintendent of Police (Addl SP)**. Assists the SP in managing police operations within the district. The Addl SP may oversee specific departments or areas within the district.

(g) **Deputy Superintendent of Police (DySP)**. Manages police activities in a subdivision. The DySP is responsible for maintaining law and order, investigating crimes and supervising police personnel.

(h) **Station House Officer (SHO)**. In charge of a police station and responsible for maintaining law and order in the area. The SHO oversees the work of police personnel within the station and handles investigations and public complaints.

11. State police forces are crucial for day-to-day law enforcement and public safety. They work closely with the CAPF and other central agencies to address security challenges and maintain peace. However, Union Territories are policed by the Police Forces of Union Territories, (headed by a DGP/IG of Police, an IPS officer) which comes directly under control

of Ministry of Home Affairs (MHA). A broad general structure depicting the State Police organisation is given below:-

12. **<u>Coordination between CAPF and State Police</u>**. The CAPF and State Police forces often work together to address security challenges. While the CAPF operates under the MHA, State Police forces come under the Department of Home of their respective state governments. This dual structure ensures a comprehensive approach to maintaining law and order across the country.

(a) **<u>Joint Operations</u>**. CAPF and State Police conduct joint operations to tackle terrorism, insurgency and other security threats. These operations involve coordinated efforts to ensure effective results.

(b) **<u>Training and Capacity Building</u>**. CAPF and State Police personnel undergo joint training programs to enhance their skills and capabilities. These programs focus on various aspects of law enforcement, counter-terrorism and disaster management.

(c) **<u>Intelligence Sharing</u>**. CAPF and State Police share intelligence to prevent and respond to security threats. This collaboration helps in timely action and effective management of security situations.

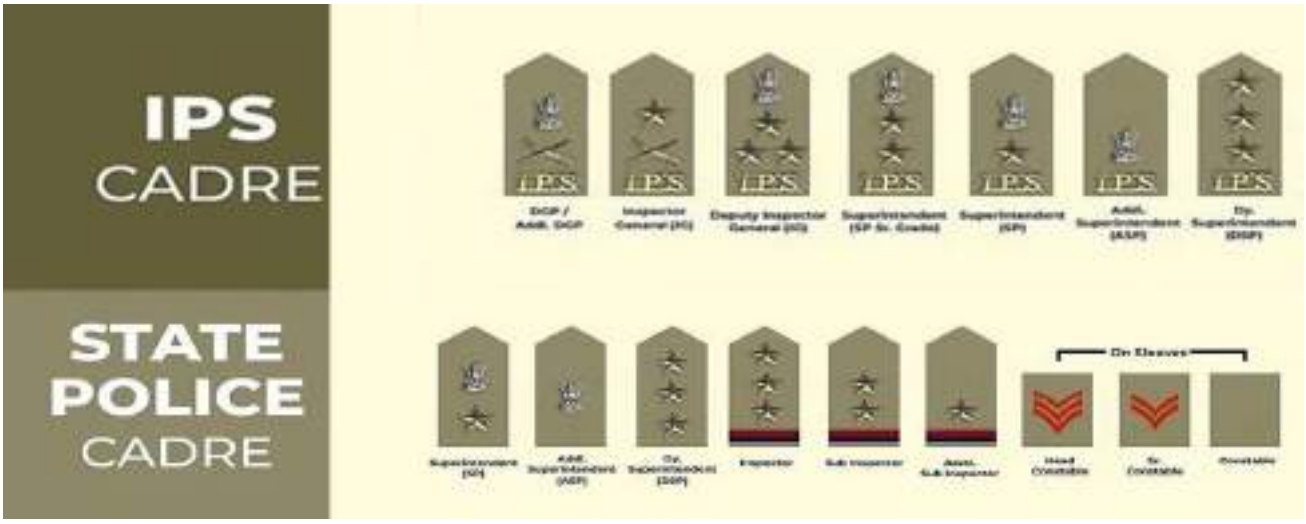
(d) **<u>Disaster Response</u>**. During natural and man-made disasters, CAPF and State Police work together to conduct immediate rescue operations.

PART IV – BADGES OF RANK

13. Here is a detailed overview of the badges of rank for the Central Armed Police Forces (CAPF) and the State Police forces in India. This will help you understand the hierarchy and insignia associated with different ranks. The rank structure in the CAPF is similar across different forces like CRPF, BSF, CISF, ITBP and SSB. This structure ensures a clear hierarchy and command chain, facilitating effective operations and administration within the force. Here are the ranks and their Insignia:-

RANK	INSIGNIA
Director General (DG)/ Additional Director General (ADG)	National emblem over crossed sword and baton
Inspector General (IG)	Star over crossed sword and baton
Deputy Inspector General (DIG)	National emblem over three stars in a triangular formation
Senior Superintendent (SP Sr. Grade)/ Commandant	National emblem over two stars
Superintendent (SP)/ Second in Command 2 I/C	National emblem over one star
Addl Superintendent (ASP)/ Deputy Commandant	National emblem
Deputy Superintendent (DSP)/ Assistant Commandant	Three stars in a line
Inspector	Three Stars in a line with a stripe
Sub-Inspector	Two Stars with a stripe
Assistant Sub-Inspector	One Star with a stripe
Head Constable	Three chevrons pointing downwards
Senior Constable	Two chevrons pointing downwards
Constable	No insignia

RANK STRUCTURE OF STATE POLICE CADRE



RANK STRUCTURE OF CAPF CADRE

14. Unlike the rank structure of CAPF, the structure of the Assam Rifles is similar to that of the Indian Army, reflecting its paramilitary nature and operational alignment. To avoid any confusion comparative rank structures of Indian Army and Police Forces (IPS ranks) are given as under for your better understanding.

EQUIVALENCE OF RANKS OF INDIAN ARMY AND POLICE

Indian Army	Police
Field Marshal	No Equivalent Rank in police
General	
Lieutenant General	Director General of Police (DGP) / Additional Director General of Police (ADGP)
Major General	Inspector General
Brigadier	Deputy Inspector Gen (DIG)
Colonel	Superintendent (SP Sr. Grade)
Lieutenant Colonel	Superintendent (SP)
Major	Additional Superintendent (ASP)
Captain	Deputy Superintendent (DSP)
Lieutenant	Assistant Superintendent

HONOURS AND AWARDS

15. Like the Army, CAPF and Police are also awarded decorations, honours and awards for extra-ordinary contribution, courage and bravery, as well as for distinguished service during times of war and peace. These awards not only acknowledge individual acts of valour and exceptional service but also serve to motivate and inspire others in the force. Apart from the Awards of Ashoka Chakra, Kirti Chakra and Shaurya Chakra for which the Indian Armed Forces personnel, Police Organization Personnel as well as civilians are eligible, certain special awards enlisted by the Government of India for the Police Forces are as under:-

(a) **President's Police Medal for Gallantry (PPMG)**

(i) **Description**. Awarded for conspicuous gallantry in saving life and property, or in preventing crime or arresting criminals.

(ii) **Eligibility**. Police personnel.

(b) **Police Medal for Gallantry (PMG)**

(i) **Description**. Awarded for gallantry in saving life and property, or in preventing crime or arresting criminals.

(ii) **Eligibility**. Police personnel.

(c) **President's Police Medal for Distinguished Service (PPMDS)**

(i) **Description**. Awarded for a long and distinguished service in the police force.

(ii) **Eligibility**. Police personnel.

(d) **Police Medal for Meritorious Service (PMMS)**

(i) **Description**. Awarded for a long and meritorious service in the police force.

(ii) **Eligibility**. Police personnel.

OTHER NOTABLE AWARDS INCLUDE

Ser	Awards	Description	Eligibility
(a)	**Jeevan Raksha Padak**	Awarded for meritorious act of human nature in saving the life of a person.	Civilians and police personnel.

Ser	Awards	Description	Eligibility
(b)	**Home Minister's Special Operation Medal**	Awarded for special operations in the field of internal security, law and order and counter-insurgency.	Police and CAPF personnel.
(c)	**Internal Security Medal**	Awarded for significant contributions to internal security.	Police and CAPF personnel.
(d)	**Disaster Response Medal**	Awarded for exceptional service during disaster response operations.	Police and CAPF personnel.
(e)	**Union Home Minister's Medal for Excellence in Police Training**	Awarded to police trainers for outstanding performance in training activities.	Police trainers and instructors
(f)	**Antarik Suraksha Medal**	Awarded for significant contributions to internal security.	Police and CAPF personnel.
(g)	**Ati Utkrisht Seva Padak**	Awarded for exceptionally outstanding service in the police force.	Police personnel
(h)	**Utkrisht Seva Padak**	Awarded for outstanding service in the police force.	Police personnel.

16. **Importance of Honours and Awards**. Honours and awards play a crucial role in:-

(a) **Motivating Personnel**. Recognizing the efforts and sacrifices of personnel boosts morale and encourages others to perform their duties with dedication.

(b) **Public Recognition**. Awards bring public recognition to the bravery and service of police and CAPF personnel, fostering a sense of pride and respect.

(c) **Historical Record**. Documenting acts of bravery and service ensures that the contributions of personnel are remembered and honoured for future generations.

17. **Recognition and Ceremony** The awards are usually presented by the President of India or the Governors of the respective states during ceremonial events such as Republic Day and Independence Day. These ceremonies are significant events that highlight the bravery and dedication of the awardees. This comprehensive overview of honours and awards should help cadets understand the various recognitions available to CAPF and State Police personnel.

CONCLUSION

18. The Central Armed Police Forces (CAPF) and State Police forces are integral to India's security framework, each playing distinct yet complementary roles. The CAPF, under the Ministry of Home Affairs (MHA), includes specialized forces like the CRPF, BSF, CISF, ITBP, SSB, NSG and Assam Rifles, each tasked with unique responsibilities ranging from border security to counter-insurgency and disaster response. Their structured hierarchy and specific roles ensure a robust response to various security challenges.

19. The Central Police Organizations (CPOs), including both armed and non- armed entities, enhance the country's internal security through intelligence gathering, crime investigation and law enforcement. Agencies like the CBI, IB, NCRB and NIA, along with training institutions such as SVPNPA and NEPA, play crucial roles in maintaining law and order and advancing policing standards.

20. State Police forces, operating under their respective state governments, are the frontline defenders of law and order at the local level. Their hierarchical structure, from the Director General of Police (DGP) to constables, ensures effective management and response to local security needs.

21. Understanding the badges of rank is essential for recognizing the hierarchy and authority within these forces. These badges ensure a clear hierarchy and command chain, facilitating effective operations and administration within the force.

22. In conclusion, the comprehensive study of the CAPF, CPOs and State Police forces, alongwith their rank structures, provides NCC cadets with valuable insights into the operational dynamics, challenges and achievements of India's security forces. This knowledge fosters a deeper commitment to serving the nation with honour and integrity, preparing cadets for potential careers in these esteemed forces and instilling a sense of respect and appreciation for those who dedicate their lives to the country's security and safety.

SUMMARY

- The Central Police Organisations include both armed and non-armed organizations. The armed police organisations are known as the CAPF, while the non-armed organisations include agencies like the CBI, IB, NCRB etc.
- The CAPF includes seven key forces. Assam Rifles, Border Security Force (BSF), Central Industrial Security Force (CISF), Central Reserve Police Force (CRPF), Indo-Tibetan Border Police (ITBP), National Security Guard (NSG) and Sashastra Seema Bal (SSB).
- Non-armed organisations of CPOs like BPR&D, CBI, DCPW, IB, NCRB and NICFS are responsible for various security roles, including border protection, counter-insurgency and internal security.
- Other agencies such as the CEIB, DGRI, ED and RAW under the Ministry of Finance and the Cabinet Secretariat are also involved in economic intelligence and external security,
- The State Police forces are crucial for maintaining law and order at the state level. The hierarchy includes ranks from the Director General of Police (DGP) to constables, ensuring an organized and efficient force capable of addressing local security needs.
- The rank structure for the Assam Rifles, aligns more closely with the Indian Army.
- Key awards include the President's Police Medal for Gallantry (PPMG), Police Medal for Gallantry (PMG) and other notable awards such as the Jeevan Raksha Padak and Home Minister's Special Operation Medal

This summary encapsulates our detailed discussion, providing a clear and concise overview of the key points covered.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Which force is responsible for guarding the Indo-Myanmar border?

(a) BSF
(b) CRPF
(c) Assam Rifles
(d) ITBP

Q2. What is the primary role of the CISF?

(a) Border security
(b) Industrial security
(c) Counter-insurgency
(d) Disaster response

Q3. Which organization is India's premier investigative agency?

(a) IB
(b) CBI
(c) NIA
(d) NCRB

Q4. The National Security Guard (NSG) is also known as.

(a) Black Cats
(b) Red Berets
(c) Blue Helmets
(d) Green Berets

Q5. Which rank in the CAPF is denoted by the insignia of three stars in a line?

(a) Assistant Commandant
(b) Deputy Commandant
(c) Inspector
(d) Sub-Inspector

Q6. Which ministry is responsible for overseeing the Central Armed Police Forces (CAPF) in India?

(a) Ministry of Defence
(b) Ministry of External Affairs
(c) Ministry of Home Affairs (MHA)
(d) Ministry of Law and Justice

Q7. Which force is responsible for guarding the Indo-China border?

(a) BSF (b) CRPF
(c) ITBP (d) SSB

Q8. The National Crime Records Bureau (NCRB) is primarily responsible for.

(a) Counter-terrorism
(b) Crime data collection and analysis
(c) Border security
(d) Disaster response

Q9. Which rank in the State Police is the highest?

(a) Superintendent of Police (SP)
(b) Deputy Superintendent of Police (DySP)
(c) Inspector General of Police (IGP)
(d) Director General of Police (DGP)

Q10. Which group of organisations falls under the category of non-armed police organisations in the Central Police Organisations (CPOs)?

(a) Central Armed Police Forces (CAPF)
(b) Intelligence Bureau (IB)
(c) National Crime Records Bureau (NCRB)
(d) Both b) and c)

Q11. Which organization provides security to critical infrastructure installations like airports and nuclear power plants?

(a) CRPF
(b) CISF
(c) BSF
(d) ITBP

Q12. The Sardar Vallabhbhai Patel National Police Academy (SVPNPA) is responsible for training.

(a) State Police officers
(b) Indian Police Service (IPS) officers
(c) Central Armed Police Forces (CAPF) personnel
(d) Intelligence Bureau (IB) agents

Q13. What is one of the ways CAPF and State Police forces collaborate to address security challenges?

(a) Conducting independent operations
(b) Competing for resources
(c) Training and capacity building programs
(d) Managing foreign relations

Q14. The rank of Subedar Major in Assam Rifles is denoted by.

(a) Three stars
(b) National emblem
(c) Two stars
(d) One star

Q15. Which force is known for its high-altitude operations and mountaineering skills?

(a) BSF
(b) CRPF
(c) ITBP
(d) SSB

Short Answer Type Questions

Q1. What is the primary role of the Border Security Force (BSF)?

Q2. Name the training institutions responsible for training IPS officers and police officers from the northeastern states.

Q3. What is the significance of the President's Police Medal for Distinguished Service (PPMDS)?

Q4. Which force is known as the "Black Cats" and what are its primary responsibilities?

Q5. List the key functions of the National Crime Records Bureau (NCRB).

Long Answer Type Questions

Q1. Discuss the roles and responsibilities of the Central Armed Police Forces (CAPF) in maintaining internal security and border protection in India.

Q2. Explain the structure and functions of the Ministry of Home Affairs (MHA) and its oversight of the Central Police Organizations (CPOs).

Q3. Describe the rank structure and insignia of the State Police forces in India, highlighting the roles of key positions.

Q4. Analyse the importance of honours and awards in the CAPF and State Police forces and how they contribute to motivation and public recognition.

Q5. Compare and contrast the roles of the Intelligence Bureau (IB) and the Central Bureau of Investigation (CBI) in India's internal security framework.

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF V: ROLE & TASKS OF COMBAT ARMS, COMBAT SUPPORT ARMS AND SERVICES

TEACHING INSTRUCTIONS

Period	**:**	**02 (80 Mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**2nd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 05 Mins**
- **Part I : 15 Mins**
- **Part II : 15 Mins**
- **Part III : 20 Mins**
- **Part IV : 20 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. The mission of the Indian Armed Forces is to ensure national security and unity, to defend the nation from external aggression and internal threats and to maintain peace and security within its borders. The primary role of Indian Army is to be the lead agency in fulfilling the mission as stated above against and land based external and internal threats ensuring sovereignty and territorial integrity of our country. In addition, when requisitioned, it conducts humanitarian rescue operations, relief operations during natural calamities and is employed in aid to civil authorities. India is also one of the largest troop contributors to the UN and to fulfil this mandate Indian Army takes part as Indian contingent in nominated UN Peace Keeping Missions.

2. The Indian Armed Forces are structured into different branches, each with specific responsibilities. Combat Arms units such as Infantry, Armoured Corps and Mechanised Infantry, are directly involved in engaging and defeating enemy forces. Combat Support arms provide essential support to combat units, including intelligence, communications, engineering and logistics. Services ensure the overall functioning and sustainability of military operations by providing medical care, supply chain management and other critical support functions.

3. Additionally, this chapter will cover some significant military operations conducted since independence, providing a historical context to the role performed by the Indian Armed Forces. The command-and-control structure, which ensures effective leadership and coordination within the military, will also be discussed. Finally, an overview of field formations, including Corps, Divisions and Brigades, will be provided to bring out the organizational hierarchy and deployment mechanics of the Indian Army.

PREVIEW

The lecture will be conducted in the following parts:

- **Part I: Role and Tasks of Combat Arms**.
- **Part II: Role and Task of Combat Support Arms**.
- **Part III: Role and Task of Services**
- **Part IV: Major Operations and peace-keeping missions since Independence**.
- **Part V: Command and Control of Field Formations**.

LEARNING OBJECTIVES

- **Role and task of all components of Indian army – Combat Arms, Combat Support Arms and Services**.
- **Details about major operations and missions of Indian Armed Forces**.
- **Their field formations and command & control setup**.

PART I: ROLE AND TASK OF COMBAT ARMS

4. Combat arms are the frontline units of the Indian Armed Forces, directly engaging in combat operations to achieve strategic and tactical objectives. These units are essential for both offensive and defensive operations, providing the necessary firepower, mobility and versatility to confront and defeat enemy forces. In the Indian Army, the primary branches of combat arms include the Armoured Corps, Infantry and Mechanised Infantry, each with distinct role and tasks that contribute to the overall accomplishment of any military objective.

5. **Armoured Corps**.

(a) **Role(Mobile and Offensive Action)**. The Armoured Corps is an organisation with tanks as the main fighting weapon platforms. It is designed to deliver powerful, rapid strikes against enemy positions, utilizing speed, firepower and protection to conduct swift and decisive attacks. Their role is crucial in manoeuvre warfare, where mobility and the ability to exploit enemy weaknesses by outflanking the enemy are key to success.

(b) **Tasks**.

(i) **Deep Penetration Operations**. Conducting operations that penetrate deep into enemy territory to disrupt command and control structures and cause destruction.

(ii) **Engaging Enemy Armoured Units**. Out manoeuvring and destroying enemy tanks and armoured vehicles.

(iii) **Providing Fire Support**. Offering direct fire support to Infantry and other units during offensive and defensive operations.

(iv) **Securing Key Terrain**. Capturing and holding strategic positions that are vital for the success of broader military objectives.

6. **Infantry**.

(a) **Role (Close Combat and Securing Ground)**. The Infantry is responsible for engaging enemy forces directly and maintaining control over strategic positions. They operate by fire and mov tactics, close in with the enemy and neutralise all opposition, capturing important ground enemy. Similarly, they also hold key location, repel any enemy and destroy the enemy by counter attack after weakening him. Since they operate on foot, they are versatile and capable of operating in any terrains and in any combat scenario.

(b) **Tasks**.

(i) **Patrols and Reconnaissance**. Conducting patrols to gather intelligence and maintain security in operational areas.

(ii) **Direct Combat Engagement**. Engaging enemy forces in close combat, utilizing a range of weapons and tactics.

(iii) **Capturing Positions**. Capturing important locations by attacking the enemy, close in by fire and move, neutralising enemy by accurate fire of direct and indirect firing weapons and capturing the objectives.

(iv) **Securing Positions**. Establishing and defending strategic positions and infrastructure.

(v) **Support Operations**. Providing support to other units through coordinated fire and manoeuvre tactics, ensuring the success of combined arms operations.

7. **Mechanised Infantry**.

(a) **Role (Enhanced Mobile Warfare and Securing Ground)**. The Mechanised Infantry enhances the mobility and protection of foot soldiers by equipping them with armoured vehicles such as Infantry Combat Vehicles (ICVs) or Armoured Personnel Carriers (APCs). These troops engage in combat utilising tactics from both armoured and Infantry units. This approach enables swift deployment, comparable to tanks and improves survival rates in battle zones. Mechanised Infantry serves as a link between conventional Infantry and armoured divisions, thereby increasing operational efficacy. Like Infantry, they can also close in with the objective, capture objective and hold it for limited time.

(b) **Tasks**.

(i) **Rapid Assaults**. Conducting swift assaults to capture and secure objectives, often in coordination with armoured units.

(ii) **Mobile Warfare**. Enhanced mobility and protection allow them to operate effectively in high-threat environments with armoured units. They manoeuvre with tanks, occupy advantageous locations to destroy enemy mechanise forces.

(iii) **Combined Arms Operations**. Supporting integrated operations with other combat arms, ensuring a cohesive and effective combat strategy.

(iv) **Mobile Fire Support**. Providing fire support to other combat arms enhancing their combat effectiveness.

This section highlights the distinct roles and tasks of the combat arms, emphasizing their contributions to the overall effectiveness and success of military operations. Each branch, with its unique capabilities, plays a vital role in achieving strategic objectives and maintaining national security.

DID YOU KNOW?

- Tanks are highly effective and destructive war fighting machines which is the main stay of any operation of Tank regiments. Modern tanks with their armour, mobility, protection and fire power are most suited for prevailing battle field conditions in open country and are widely used by all armies.
- Indian Army's Mechanised Infantry Regiment was raised on 02 April 1979, it is the newest regiment in the Indian Army and combines cutting-edge technology with military tradition. The Regiment has 27 Mechanised Infantry battalions and along with 21 battalions of the Brigade of the Guards makes up the Mechanised Infantry Forces of the country.
- Infantry Battalion is the basic unit of Infantry which has fighting companies, support companies and logistic companies which can fight and sustain itself in a battle field. A standard Indian Infantry Battalion has four Rifle Companies, one Support Company and One Head Quarter Company (Logistic Company). A group of similar Infantry units of Indian Army makes an Infantry Regiment like the Sikh Light Infantry Regiment. Indian Army has 25 Infantry Regiments

INSIGNIA OF SOME INDIAN INFANTRY REGIMENTS

ALL INFANTRY REGIMENTS OF INDIAN ARMY

Ser No	Regiment	Year of Raising
1.	PARA	1761
2.	PUNJAB	1705
3.	MADRAS	1758
4.	GRENADIERS	1796
5.	MARATHA LI	1768
6.	RAJ RIF	1817
7.	RAJPUT	1798
8.	JAT	1817
9.	SIKH	1846
10.	SIKH LI	1941
11.	DOGRA	1858
12.	GARH RIF	1901
13.	KUMAON (including NAGA)	1730

Ser No	Regiment	Year of Raising
14.	ASSAM	1941
15.	BIHAR	1941
16.	MAHAR	1941
17.	JAK RIF (including LADAKH SCOUTS)	1837
18.	JAK LI	1948
19.	1 GR	1815
20.	4 GR	1857
21.	3 GR	1815
22.	9 GR	1817
23.	5 GR	1858
24.	8 GR	1836
25.	11 GR	1948

PART II: ROLE AND TASK OF COMBAT SUPPORT ARMS

8. Combat support arms provide essential operational assistance to combat units, enhancing their effectiveness and ensuring the success of military operations. These units offer specialized support in areas such as fire support, air defence, reconnaissance, engineering, communications and intelligence. The primary branches of combat support arms include Artillery, Army Air Defence, Army Aviation Corps, Corps of Engineers, Corps of Signals and Intelligence Corps, each having distinct role and tasks.

Artillery Gun

Mobile Base Transceiver Station

Helicopter of AAC

Akash Surface to Air Missile

9. **Artillery**

(a) **Role**.

(i) **Fire Support**. Providing indirect fire to support combat operations.

(ii) **Area Denial and Force Protection**. Using artillery to deny enemy access to key areas and protect friendly forces.

(b) **Tasks**.

(i) **Indirect Fire Missions**. Delivering accurate and sustained firepower to neutralize or destroy enemy targets.

(ii) **Counter-Battery Fire**.Targeting and neutralizing enemy artillery units.

(iii) **Suppression of Enemy Air Defences (SEAD)**. Disabling enemy air defence systems to protect friendly aircraft.

(iv) **Smoke and Illumination**. Using smoke to obscure enemy vision and illumination rounds to enhance visibility for friendly forces.

DID YOU KNOW?

- The rate of fire for air defence (AD) is measured in rounds per minute (RPM). Here are some examples of some guns:-
- **M61 Vulcan**. This 20mm rotary cannon has a rate of fire of about 6,000 RPM.
- **Oerlikon GDF**. This 35mm twin-barrel autocannon has a rate of fire of about 1,100 RPM per barrel.
- **ZSU-23-4 Shilka**. This 23mm quad-barrel self-propelled anti-aircraft gun has a rate of fire of about 3,400 RPM.
- The Sarvatra Multi-Span Mobile Bridge System, developed by the Defence Research and Development Organisation (DRDO), is designed to bridge gaps of up to 75 meters using five scissor bridges, each with a span of 15 meters. This system allows combat battalions to cover significant distances by quickly deploying bridges over obstacles like rivers and ravines, ensuring mobility and operational efficiency in various terrains.

10. **Army Air Defence**

(a) **Role**. Air Defence to Mobile Forces and Vital Areas/Vital Points (VAs/VPs). Protecting mobile forces and critical infrastructure from aerial threats.

(b) **Tasks**.

(i) **Detection and Tracking**. Identifying and monitoring enemy aircraft and missiles using specialized radars.

(ii) **Engagement**. Using surface-to-air missiles and anti-aircraft guns to destroy or neutralize aerial threats.

(iii) **Coordination with Air Force**. Working closely with Air Force units to ensure comprehensive air defence coverage.

(iv) **Protection of Key Assets**. Defending vital areas and points such as command centres, logistics hubs and critical infrastructure.

11. **Army Aviation**

(a) **Role**. Reconnaissance and Observation. Conducting aerial reconnaissance and observation missions to gather intelligence and support ground operations.

(b) **Tasks**.

(i) **Air Assault**. Used for air assault on enemy bargets though attack helicopters.

(ii)) **Combat Support**. Provides combat support to fighting aircraft.

(iii) **Aerial Surveillance**. Monitoring enemy movements and positions from the air.

(iv) **Target Acquisition**. Identifying and designating targets for artillery and other combat units.

(v) **Medical Evacuation (MEDEVAC)**. Providing rapid evacuation of wounded personnel from the battlefield.

(vi) **Logistical Support**. Transporting troops, equipment and supplies to and from operational areas.

12. **Corps of Engineers**

(a) **Role**. Fortifications, Demolitions, Track Work and Obstacle Creation/Removal. Enhancing battlefield mobility and survivability through engineering tasks.

(b) **Tasks**.

(i) **Construction of Defensive Positions**. Building fortifications, bunkers and other defensive structures.

(ii) **Demolitions**. Conducting controlled demolitions to destroy enemy obstacles and infrastructure.

(iii) **Obstacle Creation and Removal**. Placing and clearing mines, barriers and other obstacles to control movement on the battlefield.

(iv) **Bridging Operations**. Constructing temporary bridges to enable the movement of troops and vehicles across water obstacles.

13. **Corps of Signals**

(a) **Role**. Communication in Orders and Instructions and ensuring reliable and secure communication for command and control of military operations.

(b) **Tasks**.

(i) **Establishing Communication Networks**. Setting up and maintaining communication systems for voice, data and video transmission.

(ii) **Signal Intelligence (SIGINT)**. Intercepting and analysing enemy communications.

(iii) **Electronic Warfare (EW)**. Disrupting enemy communications and protecting friendly communication networks.

(iv) **Cyber Operations**. Defending against cyber threats and conducting offensive cyber operations.

14. **Intelligence Corps**

(a) **Role**. Gathering, Analysing and Disseminating Military Information. Providing actionable intelligence to support decision-making and operations.

(b) **Tasks**.

(i) **Human Intelligence (HUMINT)**. Collecting information from human sources.

(ii) **Imagery Intelligence (IMINT)**. Analysing aerial and satellite imagery.

(iii) **Signals Intelligence (SIGINT)**. Intercepting and analysing enemy communications and electronic signals.

(iv) **All-Source Analysis**. Integrating information from various sources to produce comprehensive intelligence reports.

(v) **Dissemination**. Distributing intelligence to commanders and units in a timely manner.

15. This section highlights the distinct roles and tasks of the combat support arms, emphasizing their contributions to the overall effectiveness and success of military operations. Each branch, with its specialized capabilities, plays a vital role in supporting combat units and achieving strategic objectives.

PART III: ROLE AND TASK OF SERVICES

16. Services are essential for the smooth functioning and sustainability of military operations. These units provide critical logistical, medical, engineering and administrative support, ensuring that combat and combat support arms can perform their duties effectively both during peace

and war. The primary branches of supporting services with their role and tasks are given as under:-




17. **Electrical and Mechanical Engineering (EME)**

(a) **Role**. Maintenance and Repair and ensuring the operational readiness of military equipment through maintenance and repair.

(b) **Tasks**.

(i) **Design and Development**. Creating and testing electrical and mechanical systems and components.

(ii) **Maintenance**. Performing routine and emergency maintenance on vehicles, weapons and other equipment.

(iii) **Troubleshooting**. Diagnosing and fixing mechanical and electrical issues.

(iv) **Upgrades and Modifications**. Implementing upgrades and modifications to enhance equipment performance.

18. **Army Service Corps (ASC)**

(a) **Role**. Logistical Support and providing essential supplies and transportation to sustain military operations.

(b) **Tasks**.

(i) **Supply Chain Management**. Managing the procurement, storage and distribution of food, fuel and other supplies.

(ii) **Transportation**. Coordinating the movement of troops, equipment and supplies using various modes of transport.

(iii) **Field Services**. Offering services such as laundry, bakery and water supply in operational areas.

19. **Army Ordnance Corps**

(a) **Role**. Supplyand maintenance of Ordnance and managing the supply and maintenance of weapons, ammunition and military equipment.

(b) **Tasks**.

(i) **Storage and Distribution**. Ensuring the safe storage and timely distribution of ordnance stores.

(ii) **Maintenance and Repair**. Conducting maintenance and repair of weapons and equipment.

(iii) **Inventory Management**. Keeping accurate records of ordnance inventory and ensuring accountability.

20. **Army Medical Corps (AMC)**

(a) **Role**. Provide Medical Support and comprehensive medical care to military personnel.

(b) **Tasks**.

(i) **Emergency Care**. Delivering immediate medical care on the battlefield.

(ii) **Routine Treatment**. Offering routine medical services at health centres and hospitals.

(iii) **Health Promotion**. Conducting health promotion and disease prevention programs.

(iv) **Medical Evacuation**. Coordinating the evacuation of injured personnel from combat zones.

21. **Army Dental Corps**

(a) **Role**. Dental Health and ensuring the dental health of military personnel.

(b) **Tasks**.

(i) **Dental Care**. Providing routine and emergency dental care.

(ii) **Preventive Dentistry**. Conducting dental health education and preventive care programs.

(iii) **Field Support**. Offering dental services in operational areas to maintain dental readiness.

22. **Military Nursing Service (MNS)**

(a) **Role**. Providing Nursing Care. Providing nursing care to military personnel and their families.

(b) **Tasks**.

(i) **Patient Care**. Delivering high-quality nursing care in Military Hospitals and field units.

(ii) **Health Education**. Educating military personnel on health and wellness.

(iii) **Support in Operations**. Assisting in medical operations and humanitarian missions.

23. **Remount and Veterinary Corps**

(a) **Role**. Animal Care and managing the health and welfare of military animals.

(b) **Tasks**.

(i) **Veterinary Services**. Providing medical care to military animals.

(ii) **Animal Training**. Training animals for various military roles.

(iii) **Breeding and Remounting**. Managing breeding programs and remounting operations.

24. **Army Education Corps (AEC)**

(a) **Role**. Provide Educational Support and enhancing the educational and professional development of military personnel.

(b) **Tasks**.

(i) **Training Programs**. Conducting educational and training programs.

(ii) **Career Development**. Providing career counselling and development services.

(iii) **Literacy and Language Training**. Offering literacy and language training to improve communication skills.

25. **Corps of Military Police**

(a) **Role**. Ensure Law Enforcement and Military Policing and maintaining law and order within the military.

(b) **Tasks**.

(i) **Security Operations**. Conducting security operations to protect military installations and personnel.

(ii) **Traffic Control**. Managing traffic and transportation within military areas.

(iii) **Investigation**. Investigating crimes and incidents involving military personnel.

26. **Army Postal Service**

(a) **Role**. Provide postal services to military personnel during peacetime and operations.

(b) **Tasks**.

(i) **Mail Processing and Distribution**. Process, transport and distribute personal and official mail.

(ii) **Special Services**. Handle special services like registered mail and money orders.

(iii) **Efficient Mail Operations**. Ensure efficient mail operations in various locations, including remote and conflict areas.

27. **Judge Advocate General Branch (JAG)**.

(a) **Role**. Legal Support. Providing legal services and advice to the Indian Armed Forces.

(b) **Tasks**.

(i) **Legal Advice**. Offering legal advice on military operations and personnel matters.

(ii) **Military Justice**. Administering military justice and conducting court-martials.

(iii) **Legal Education**. Educating military personnel on legal issues and regulations.

28. **Military Engineering Services (MES)**.

(a) **Role**. Infrastructure Development and constructing and maintaining military infrastructure.

(b) **Tasks**.

(i) **Construction Projects**. Building and maintaining military facilities and infrastructure.

(ii) **Utilities Management**. Managing utilities such as water, electricity and sewage.

(iii) **Environmental Management**. Ensuring environmental compliance and sustainability in military operations.

29. **Border Roads Organization (BRO)**.

(a) **Role**. Road Construction and Maintenance and developing and maintaining road networks in border areas.

(b) **Tasks**.

(i) **Road Construction**. Building roads to improve connectivity and mobility in border regions.

(ii) **Maintenance**. Maintaining and repairing existing road networks.

(iii) **Strategic Projects**. Undertaking strategic infrastructure projects to support military operations.

30 **Army Pioneer Corps**.

(a) **Role**. Barrier Support and providing labour support for various military tasks.
(b) **Tasks**.

(i) **Construction Support**. Assisting in construction and engineering projects.

(ii) **Logistical Support**. Providing manpower for logistical operations.

(iii) **Field Operations**. Supporting field operations with labour-intensive tasks.

31. This section highlights the distinct roles and tasks of the supporting services, emphasizing their contributions to the overall effectiveness and sustainability of military operations. Each branch, with its specialized capabilities, plays a vital role in supporting combat and combat support arms and achieving strategic objectives.

PART IV: MAJOR OPERATIONS AND PEACE KEEPING MISSIONS SINCE INDEPENDENCE

32. Since independence, the Indian Armed Forces have been involved in numerous significant operations, both within and outside the country. These operations have been crucial in defending national sovereignty, maintaining internal security and contributing to international peacekeeping efforts. This section provides an overview of some of the major operations and peacekeeping missions conducted by the Indian Armed Forces.

33. **Major Operations**.

(a) **Indo-Pakistan War of 1947-1948**.

(i) **Objective**. To defend Jammu and Kashmir from Pakistani tribal invaders and regular forces.

(ii) **Outcome**. It resulted in eviction of the Pakistani tribal and regular forces in valleys from large areas of the princely state of Jammu and Kashmir and

establishment of the Line of Control (LoC) and the accession of princely state to India.

(b) **Sino-Indian War (1962)**.

(i) **Objective**. To defend against Chinese incursions in the Aksai Chin and Arunachal Pradesh regions.

(ii) **Outcome**. The war ended with universe withdrawal to its pre-war position, creation of Line of Actual Control and also highlighted the need for modernization and restructuring of the Indian Armed Forces.

Rifle-toting Indian soldiers on patrol during the brief, bloody 1962 Sino-Indian border War

(c) **Indo-Pakistan War of 1965**.

(i) **Objective**. To counter Pakistani aggression in the Rann of Kutch and Jammu and Kashmir.

(ii) **Outcome**. Even though Pakistan never formally conceded defeat, the loss of strategic Haji Pir Pass and threatening of the major Pakistani city of Lahore forced them to agree to a United Nation brokered ceasefire.

(d) **Indo-Pakistan War of 1971**.

(i) **Objective**. To support the independence movement in East Pakistan (now Bangladesh) and counter Pakistani military actions.

(ii) **Outcome**. The creation of Bangladesh, capture of Prisoners of War (PoW) of Pakistani Army and a decisive victory for India, significantly established Indian supremacy in the geopolitical landscape of South Asia.

(e) **Kargil War (1999)**.

(i) **Objective**. To evict Pakistani Army intruders from the Kargil sector in Jammu and Kashmir.

(ii) **Outcome**. A decisive victory for India, with the successful recapture of key positions and the restoration of the LoC.

Soldiers of the Indian Army depicted after capturing a hill from Pakistani forces during the Kargil War

34. **United Nations Peace-Keeping Missions**. India has been a significant contributor to United Nations peacekeeping missions since 1948. Here are some of the key peacekeeping missions that India was and is currently part of:-

(a) **Completed Peacekeeping Missions**.

(i) **United Nations Mission in Sierra Leone (UNAMSIL)**. Indian peacekeepers were involved in this mission from 1999 to 2005 to help stabilize Sierra Leone.

(ii) **United Nations Mission in Ethiopia and Eritrea (UNMEE)**. India contributed to this mission from 2000 to 2008 to monitor the ceasefire between Ethiopia and Eritrea.

(iii) **United Nations Stabilization Mission in Haiti (MINUSTAH)**. Indian peacekeepers have been part of this mission since December 1997, helping to stabilize the country.

(iv) **United Nations Mission in Liberia (UNMIL)**. Since April 2007, Indian troops have been contributing to the peacekeeping efforts in Liberia.

(b) **Ongoing Peacekeeping Missions**. Some Important UN Msn having significant Indian participation are as under:-

(i) **United Nations Interim Force in Lebanon (UNIFIL)**. Since December 1998, Indian troops have been part of this mission to maintain peace and security in Lebanon.

(ii) **United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO)**. India has been involved since January 2005, contributing to the stabilization efforts in the region.

(iii) **United Nations Mission in South Sudan (UNMISS)**. Indian peacekeepers have been part of this mission since April 2005, helping to protect civilians and support the peace process.

(c) **Relief Operations**.

(i) **Wayanad Landslides, Kerala (2024)**. The Indian Army, National Disaster Response Force (NDRF) and other agencies conducted large-scale rescue operations, saving over 4,000 people and relocating more than 10,000 to relief camps.

(ii) **Cyclone Amphan (2020)**. A super cyclone that caused extensive damage in West Bengal and Odisha. The Indian Armed Forces and NDRF were involved in rescue and relief operations, providing essential supplies and medical aid.

(iii) **Operation Surya Hope (2013)**. Launched by Indian Army to provide relief and rescue operations in the Badrinath, Hemkund and Kedarnath regions. This operation was crucial in evacuating thousands of stranded pilgrims and providing essential supplies to those affected by the floods in Uttarakhand.

(iv) **Operation Ajay (2023)**. Launched to facilitate the return of Indians from Israel during the conflict with Hamas militants

(v) **Operation Dost (2023)**. A search and rescue operation to aid Syria and Turkey after the devastating earthquake in February 2023.

35. India's commitment to UN peacekeeping missions and relief operations underscores its dedication to global peace and security, with Indian peacekeepers being recognized for their professionalism, dedication and bravery in some of the most challenging environments around the World.

36. Command and control (C2) are a critical aspect of military operations, ensuring effective leadership, coordination and execution of missions. It involves the exercise of authority and direction by commanders over assigned forces in the accomplishment of their mission. This section will explore the structure and mechanisms of command and control within the Indian Armed Forces.

37. **Command Structure**.

(a) **National Level**.

(i) **President of India**. The Supreme Commander of the Indian Armed Forces.

(ii) **Ministry of Defence (MoD)**. Responsible for the overall defence policy and administration.

(iii) **Chiefs of Staff Committee (COSC)**. Comprising the Chief of Defence Staff (CDS) and the Chiefs of the Army, Navy and Air Force, this committee provides strategic guidance and coordination.

(b) **Strategic Level**.

(i) **Integrated Defence Staff (IDS)**. Assists the COSC in joint planning and operations.

(ii) **Theatre Commands**. Proposed joint commands that integrate the capabilities of the Army, Navy and Air Force in specific geographical areas.

(iii) **Army Commands**. Seven commands, each headed by a General Officer Commanding-in-Chief (GOC-in-C), responsible for operational readiness and execution.

(iv) **Navy Commands**. Two operational commands, both headed by the Flag Officer Commanding-in-Chief (FOC-in-C), responsible for operating missions above, under or on seas.

(v) **Air Force Commands**. Five operational commands both headed by the Air Officer Commanding-in-Chief (AOC-in-C), responsible air missions.

(c) **Operation Command/Tactical Command**. Corps, Divisions and Brigades: Subordinate formations that execute tactical operations under the direction of their respective commands.

38. **Field Formations**. Field formations are the organizational structures that enable the Indian Armed Forces to conduct operations effectively. These formations range from large corps to smaller brigades, each with specific roles and responsibilities. For the ease of understanding, the same is evaluated by a flow diagram.

CONCLUSION

39. The Indian Armed Forces are integral to the nation's security, performing a wide range of roles from direct combat to logistical and medical support. Combat arms, including the Armoured Corps, Infantry and Mechanised Infantry, are at the forefront of military operations, while combat support arms and supporting services provide essential assistance and sustainment.

40. Through major operations since independence, the Indian Armed Forces have demonstrated their capability and resilience. The command-and-control structure ensures effective leadership and coordination, while field formations enable efficient operational execution.

41. In essence, the diverse branches and specialized units of the Indian Armed Forces work in unison to protect the nation and maintain peace and stability, adapting to evolving challenges and ensuring readiness for future operations. Their continued evolution and commitment to excellence underscore their vital role in safeguarding the nation's interests and contributing to global peacekeeping efforts.

SUMMARY

The Indian Armed Forces ensure national security and support civil authorities.

Combat Arms.

- **Armoured Corps**. Mobile and offensive actions; tasks include deep penetration and fire support. They play a crucial role in manoeuvre warfare.
- **Infantry**. Close combat and securing ground; tasks include patrols and direct engagement. They are versatile and operate in diverse terrains.

- **Mechanised Infantry**. Enhanced mobility and protection; tasks include rapid assaults and mobile fire support. They integrate with armoured units for coordinated operations.

Combat Support Arms.

- **Artillery**. Provides fire support and area denial to protect and assist combat units.
- **Army Air Defence**. Protects mobile forces and vital areas from aerial threats.
- **Army Aviation Corps**. Conducts reconnaissance and observation to gather intelligence.
- **Corps of Engineers**. Handles fortifications, demolitions and obstacle management.
- **Corps of Signals**. Ensures communication for command and control.
- **Intelligence Corps**. Gathers, analyses and disseminates military information

Supporting Services.

- **Maintenance and Logistics**. Electrical and Mechanical Engineering, Army Service Corps, Army Ordnance Corps ensure operational readiness and supply management.
- **Medical Support**. Army Medical Corps, Army Dental Corps, Military and Nursing Service provide comprehensive healthcare.
- **Specialized Support**. Remount and Veterinary Corps, Army Education Corps, Corps of Military Police, Judge Advocate General Branch, Military Engineering Services, Border Roads Organization, Army Pioneer Corps offer various specialized services.

MAJOR OPERATIONS

- Key operations include the Indo-Pakistan wars, Sino-Indian War and Kargil War. These operations have demonstrated the strategic importance and resilience of the Indian Armed Forces, showcasing their ability to adapt and respond to diverse challenges. Each operation has contributed to the evolving tactics and strategies of the military.
- India has also been a significant contributor to United Nations peacekeeping missions and Relief operations since its independence. Same important peace-keeping and relief missions United Nations Mission in Sierra Leone (UNAMSIL), United Nations Mission in Ethiopia and Eritrea (UNMEE), United Nations Interim Force in Lebanon (UNIFIL), United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO), United Nations Mission in South Sudan (UNMISS), United Nations Stabilization Mission in Haiti (MINUSTAH), United Nations Mission in Liberia (UNMIL)

- **Field Formations**.

  - Corps. Operational command coordinating multiple divisions.
  - Divisions. Tactical command supporting brigades.
  - Brigades. Direct combat operations and support to battalions.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary role of the Armoured Corps?

(a) Close combat
(b) Mobile and offensive action
(c) Reconnaissance
(d) Medical support

Q2. Which branch of the Indian Armed Forces is responsible for providing fire support and area denial?

(a) Infantry
(b) Artillery
(c) Army Aviation Corps
(d) Corps of Engineers

Q3. What is the main task of the Army Air Defence?

(a) Fortifications and demolitions
(b) Air defence to mobile forces and VAs/VPs
(c) Gathering and analysing military information
(d) Logistical support

Q4. Which unit is responsible for reconnaissance and observation?

(a) Armoured Corps (b) Infantry
(c) Army Aviation Corps (d) Corps of Signals

Q5. What is the role of the Corps of Engineers?

(a) Communication in command and control
(b) Fortifications, demolitions and obstacle creation/removal
(c) Medical support
(d) Legal support

Q6. Which branch handles the maintenance and repair of military equipment?

(a) Army Service Corps
(b) Army Ordnance Corps
(c) Electrical and Mechanical Engineering
(d) Corps of Military Police

Q7. What is the primary task of the Army Medical Corps?

(a) Dental care (b) Veterinary services
(c) Medical support (d) Educational support

Q8. Which branch is responsible for constructing and maintaining

(a) military infrastructure?
(b) Military Engineering Services
(c) Corps of Engineers
(d) Border Roads Organization
(e) Army Pioneer Corps

Q9. Which operation led to the creation of Bangladesh?

(a) Operation Polo
(b) Operation Blue Star
(c) Indo-Pakistan War of 1971
(d) Kargil War

Q10. What is the role of the Corps of Signals?

(a) Providing fire support
(b) Ensuring communication in command and control
(c) Conducting reconnaissance
(d) Managing logistics

Q11. Which branch is responsible for law enforcement and security within the military?

(a) Corps of Military Police
(b) Judge Advocate General Branch
(c) Army Education Corps
(d) Border Roads Organization

Q12. Which operation was conducted to aid Syria and Turkey?
(a) Operation Ajay
(b) Operation Dost
(c) Operation Pawan
(d) Operation Parakram

Q13. What is the primary role of the Intelligence Corps?

(a) Providing medical care
(b) Gathering, analysing and disseminating military information
(c) Conducting demolitions
(d) Managing road construction

Q14. Which branch provides logistical support, including supply chain management and transportation?

(a) Army Ordnance Corps
(b) Army Service Corps
(c) Electrical and Mechanical Engineering
(d) Corps of Engineers

Q15. What is the main task of the Army Dental Corps?

(a) Providing routine and emergency dental care
(b) Conducting aerial surveillance
(c) Managing military education programs
(d) Handling legal matters

Short Answer Type Questions

Q1. Describe the primary role and tasks of the Armoured Corps. What are the main responsibilities of the Corps of Engineers?

Q2. Explain the role of the Army Aviation Corps in military operations. What tasks are performed by the Army Service Corps?

Q3. How does the Corps of Signals support command and control in the Indian Armed Forces?

Long Answer Type Questions

Q1. Discuss the roles and tasks of the Infantry and how they contribute to military operations.

Q2. Explain the significance of major operations conducted by the Indian Armed Forces since independence.

Q3. Describe the command-and-control structure of the Indian Armed Forces and its importance in military operations.

Q4. Analyse the role of combat support arms in enhancing the effectiveness of combat units

Q5. Evaluate the contributions of supporting services to the overall functioning and sustainability of military operations.

INDIAN ARMED FORCES (SD/SW)

CHAPTER AF VI: ROLE AND TASK OF CAPF AND POLICE FORCES

"To protect and to serve is not just a motto, it is a way of life."

TEACHING INSTRUCTIONS

Period	**:**	**02 (80 mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**3rd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 05 Mins**
- **Part I : 20 Mins**
- **Part II : 15 Mins**
- **Part III : 15 Mins**
- **Part IV : 10 Mins**
- **Part IV : 10 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. The Central Armed Police Forces (CAPF) and State Police Forces are essential components of India's security apparatus, each playing a vital role in maintaining law and order, ensuring public safety and protecting the nation's borders. The CAPF, which includes forces like the BSF, CRPF, CISF, ITBP, NSG and Assam Rifles, is primarily responsible for border security, internal security and counter-insurgency operations. These forces are equipped and trained to handle a wide range of security challenges, from preventing illegal immigration and smuggling to responding to terrorist threats and natural disasters.

2. On the other hand, State Police forces are the primary law enforcement agencies within their respective states. They are tasked with crime prevention and investigation, traffic management, community policing and maintaining public order. By working in close coordination with the CAPF, State Police forces ensure a comprehensive approach to addressing security issues, thereby contributing to the overall stability and safety of the country. This chapter explores the specific roles and tasks of these forces, highlighting their importance in India's security landscape.

Heads of All CAPFs with Home Minister during the plantation of the 4 crores saplings under the Home Ministry's 'All India Tree Plantation Campaign'

PREVIEW

- **Part I: Role and Tasks of CAPF. Part II: Role and Task of CPOs.**
- **Part III: Role and Task of Central Investigative and Intelligence Agencies.**
- **Part IV: Role and Task of State Police.**
- **Part V: Training of Police, State Police and CAPF.**

LEARNING OBJECTIVES

- **Role and task of all CPOs including CAPF and State Police Forces.**
- **Training academies which train officers.**

PART I: ROLE AND TASK OF CAPF

3. The Central Armed Police Forces (CAPF) are a vital component of India's security framework, tasked with a wide range of responsibilities to ensure the safety and security of the nation. Each force within the CAPF has distinct roles and tasks that align with their unique capabilities and areas of operation. Here's a detailed look at the roles and tasks of each CAPF unit, linking them with the previous chapter on their structure and responsibilities.

Seven Central Armed Police Forces

4. **Assam Rifles (AR)**.

(a) **Primary Role**. Border security and counter-insurgency operations in Northeast India.

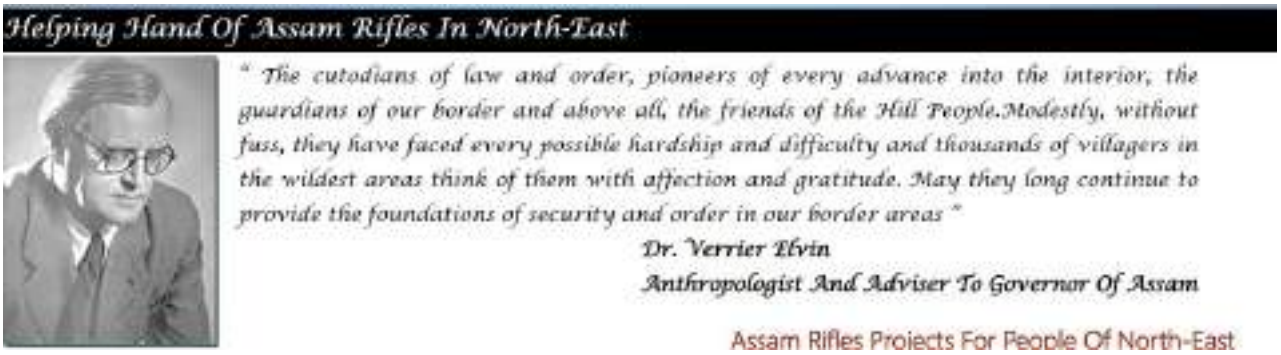
(b) **Tasks**.

(i) **Border Security**. Guarding the 1,643-kilometre-long Indo-Myanmar border to prevent illegal immigration, smuggling and infiltration.

(ii) **Counter-Insurgency**. Conducting operations to neutralize insurgent groups and maintain law and order in the region.

(iii) **Civic Action Programs**. Engaging in developmental activities to build infrastructure and provide humanitarian aid, fostering goodwill among local populations.

(iv) **Disaster Relief**. Providing assistance during natural disasters, such as floods and earthquakes, by conducting rescue and relief operations.



Assam Rifles marching contingent passes through the Rajpath during the Republic Day Parade

5. **Border Security Force (BSF)**

(a) **Primary Role**. Guarding India's international borders with Pakistan and Bangladesh.

(b) **Tasks**.

(i) **Border Surveillance**. Monitoring and patrolling the borders to prevent trans-border crimes, smuggling and unauthorized entry.

(ii) **Anti-Infiltration Operations**. Conducting operations along the Line of Control (LoC) to prevent infiltration by militants.

(iii) **Internal Security**. Assisting in maintaining internal security during elections, communal riots and other emergencies.

(iv) **Specialized Units**. Operating air and marine wings, artillery regiments and commando units for specialized task.

6. **Central Industrial Security Force (CISF)**

(a) **Primary Role**. Providing security to critical infrastructure and industrial units.

(b) **Tasks**.

(i) **Infrastructure Security**. Securing airports, seaports, nuclear installations, space establishments and other critical infrastructure.

(ii) **Public Sector Undertakings (PSUs)**. Ensuring the safety of PSUs, including power plants, steel plants and oil refineries.

(iii) **Disaster Management**. Conducting fire safety and disaster management operations to protect lives and property.

(iv) **VIP Security**. Providing security to high-risk VIPs and government officials.

7. **Central Reserve Police Force (CRPF)**.

(a) **Primary Role**. Maintaining internal security and handling law and order situations.

(b) **Tasks**.

(i) **Anti-Naxal Operations**. Conducting operations in Naxal-affected areas to neutralize insurgent groups and restore peace.

(ii) **Law and Order**. Assisting state police forces in maintaining law and order during riots, protests and other disturbances.

(iii) **Counter-Terrorism**. Engaging in counter-terrorism operations to prevent and respond to terrorist threats.

(iv) **Election Security**. Providing security during elections to ensure free and fair voting.

8. **Indo-Tibetan Border Police (ITBP)**.

(c) **Primary Role**. Guarding the Indo-China border and conducting high-altitude Operations.

(d) **Tasks**.

(i) **Border Patrolling**. Patrolling and securing the border in the Himalayan region to prevent illegal activities.

(ii) **High-Altitude Operations**. Conducting operations in high-altitude areas, including rescue and relief missions during natural disasters.

(iii) **Counter-Insurgency**. Engaging in counter-insurgency operations in high-altitude regions.

(iv) **Training and Mountaineering**. Providing specialised training in mountaineering and high-altitude warfare.

9. **National Security Guard (NSG)**.

(e) **Primary Role**. Counter-terrorism and hostage rescue operations.

(f) **Tasks**.

(i) **Anti-Terrorist Operations**. Conducting operations to neutralize terrorist threats and prevent attacks.

(ii) **Hostage Rescue**. Performing hostage rescue missions to save lives during terrorist incidents.

(iii) **Bomb Disposal**. Handling and disposing of explosive devices to prevent casualties.

(iv) **VIP Security**. Providing security to high-risk VIPs and critical installations.

NSG Commandos in Action

10. **Sashastra Seema Bal (SSB)**.

(a) **Primary Role**. Guarding India's borders with Nepal and Bhutan.

(b) **Tasks**.

(i) **Border Security**. Preventing trans-border crimes, smuggling and unauthorized entry along the Indo-Nepal and Indo-Bhutan borders.

(ii) **Internal Security**. Assisting in maintaining internal security and law and order in border areas.

(iii) **Disaster Management**. Engaging in disaster management and humanitarian aid operations during emergencies.

(iv) **Civic Action Programs**. Conducting community outreach programs to build trust and cooperation with local populations.

Combatants of various CAPFs working together to safeguard our boundaries

PART II: ROLE AND TASK OF CENTRAL POLICE ORGANISATIONS (CPOS)

11. The Central Police Organizations (CPOs) other than the CAPF also plays an equally significant role in India's internal security, law enforcement and intelligence gathering. Each organization has specific responsibilities that contribute to the overall safety and security of the nation. Here is a detailed look at the roles and tasks of the key CPOs we mentioned in the previous chapters.

12. **Bureau of Police Research and Development (BPR&D)**.

(a) **Primary Role**. Modernizing the police forces in India.

(b) **Tasks**.

(i) Conducting research on police-related issues and developing new policing techniques.

(ii) Providing training to police personnel to enhance their skills and capabilities.

(iii) Developing and implementing policies for police reforms.

(iv) Promoting the use of technology in policing to improve efficiency and effectiveness.

13. **Central Bureau of Investigation (CBI)**.

(a) **Primary Role**. Investigating high-profile and complex criminal cases.

(b) **Tasks**.

(i) Investigating cases of corruption, economic offenses and serious crimes.

(ii) Assisting state police forces in solving complex cases.

(iii) Coordinating with Interpol and other international agencies for cross-border investigations.

(iv) Conducting anti-corruption drives and ensuring transparency in public services.

14. **Directorate of Coordination of Police Wireless (DCPW)**.

(a) **Primary Role**. Providing communication support to police and security forces.

(b) **Tasks**.

(i) Establishing and maintaining a nationwide police wireless network.

(ii) Ensuring secure and reliable communication channels for police operations.

(iii) Developing and implementing communication protocols and standards.

(iv) Providing technical support and training to police personnel in communication technologies.

15. **Intelligence Bureau (IB)**.

(a) **Primary Role**. Gathering and analysing intelligence related to national security.

(b) **Tasks**.

(i) Collecting intelligence on internal and external threats to national security.

(ii) Conducting counter-intelligence operations to prevent espionage and sabotage.

(iii) Monitoring activities of terrorist groups and other anti-national elements.

(iv) Providing actionable intelligence to law enforcement agencies and the government.

16. **National Crime Records Bureau (NCRB)**.

(a) **Primary Role**. Collecting and analysing crime data.

(b) **Tasks**.

(i) Maintaining a comprehensive database of crime statistics across the country.

(ii) Analysing crime trends and patterns to assist in policy formulation.

(iii) Developing and managing the Crime and Criminal Tracking Network & Systems (CCTNS).

(iv) Providing training to police personnel in data management and analysis

PART III: ROLES OF CENTRAL INVESTIGATIVE AND INTELLIGENCE AGENCIES

17. There are some investigative and intelligence gathering agencies which are not directly under CPOs but carry out very essential and important role in multiple domains to ensure the compliance to the law and order. They function directly under the Central Government and provide investigative and intelligence getting support to all law enforcement agencies. Here is a brief overview of the roles of some key investigative and intelligence agencies that we mentioned in the previous chapters.

18. **Directorate General of Revenue Intelligence (DGRI)**.

(a) **Primary Role**. Combating smuggling and customs fraud.

(b) **Tasks**.

(i) Investigating cases of smuggling, customs duty evasion and commercial fraud.

(ii) Conducting raids and seizures to prevent illegal trade activities.

(iii) Coordinating with international agencies to combat cross-border smuggling.

19. **Directorate of Enforcement (ED)**.

(a) **Primary Role**. Enforcing economic laws and fighting financial crimes.

(b) **Tasks**.

(i) Investigating cases of money laundering, foreign exchange violations and economic offenses.

(ii) Conducting raids and seizures to gather evidence against financial criminals.

(iii) Coordinating with other national and international agencies to track and recover illicit funds.

(iv) Ensuring compliance with economic laws and regulations.

INTERESTING FACTS

- ED was initially established under the Department of Economic Affairs in 1956 as an 'Enforcement Unit', it was later shifted to the Department of Revenue for administration in 1960.
- The Zones of NCB are located at Ahmedabad, Bengaluru, Chandigarh, Chennai, Delhi, Guwahati, Indore, Jammu, Jodhpur, Kolkata, Lucknow, Mumbai and Patna.
- RAW functions under the direct command of the Prime Minister's office, however, it reports to the Cabinet Secretary of India.
- Successful operations of RAW: (a) Provided intelligence for Operation Cactus
- (b) Bangladesh Liberation war (c) Military training to African nations.

20. **Directorate General of Anti-Evasion (DGAE)**.

(a) **Primary Role**. Preventing and detecting tax evasion.

(b) **Tasks**.

(i) Investigating cases of tax evasion and fraud.

(ii) Conducting audits and inspections to ensure compliance with tax laws.

(iii) Coordinating with other enforcement agencies to combat tax-related offenses.

21. **Central Economic Intelligence Bureau (CEIB)**.

(a) **Primary Role**. Coordinating and strengthening the economic intelligence network.

(b) **Tasks**.

(i) Collecting and analysing economic intelligence related to economic offenses.

(ii) Coordinating with other enforcement agencies to combat economic crimes.
(iii) Providing intelligence inputs to the government for policy formulation.

22. **Financial Intelligence Unit - India (FIU-IND)**.

(a) **Primary Role**. Combating money laundering and terrorist financing.

(b) **Tasks**.

(i) Receiving, processing, analysing and disseminating information related to suspect financial transactions.

(ii) Coordinating with domestic and international agencies to combat financial crimes.

(iii) Ensuring compliance with anti-money laundering (AML) and counter-terrorist financing (CTF) regulations3.

DID YOU KNOW?

- The form, main central intelligence agencies and their tasks.

Joint Intelligence Committee (JIC)	Research and Analysis Wing (R&AW)	Intelligence Bureau (IB)	Military Intelligence (MI)
Apex intelligence assessment body. **Chairman usually from IPS or IAS.** **Members from ministries, govt departments.**	In charge of external intelligence. Head is Director, who is a member of JIC	Focus on internal security and counter-intelligence. Head is Director, who is a member of JIC.	The three services have their separate wings. MI under the Army is the largest of all.

23. **Directorate General of Income Tax Investigation (DGIT)**.

(a) **Primary Role**. Investigating income tax evasion and fraud.

(b) **Tasks**.

(i) Conducting searches, seizures and surveys to detect tax evasion.

(ii) Gathering intelligence on tax evasion activities.

(iii) Coordinating with other agencies to ensure compliance with income tax laws.

24. **National Technical Research Organisation (NTRO)**.

(a) **Primary Role**. Technical intelligence gathering.

(b) **Tasks**.

(i) Conducting satellite and cyber surveillance.

(ii) Providing technical intelligence support to other intelligence agencies.

(iii) Developing and deploying advanced technical solutions for intelligence gathering.

25. **Narcotics Control Bureau (NCB)**.

(a) **Primary Role**. Combating drug trafficking and abuse.

(b) **Tasks**.

(i) Enforcing laws related to narcotic drugs and psychotropic substances.

(ii) Gathering intelligence on drug trafficking and conducting operations to seize illegal drugs.

(iii) Coordinating with international agencies to combat cross-border drug trafficking.

(iv) Providing training and resources to other law enforcement agencies in drug enforcement.

26. **Research and Analysis Wing (RAW)**.

(a) **Primary Role**. External intelligence gathering.

(b) **Tasks**.

(i) Collecting intelligence on foreign threats and activities.

(ii) Conducting covert operations to safeguard national security.

(iii) Providing strategic intelligence inputs to the government.

27. **Aviation Research Centre (ARC)**.

(a) **Primary Role**. Aerial surveillance and reconnaissance.

(b) **Tasks**.

(i) Conducting aerial surveillance and reconnaissance missions.

(ii) Gathering intelligence through aerial imagery and signals intelligence.

(iii) Supporting other intelligence agencies with aerial intelligence.

28. **Special Protection Group (SPG)**.

(a) **Primary Role**. Providing security to the Prime Minister and his immediate family members residing with him at his official residence.

(b) **Tasks**.

(i) Ensuring the personal security of the Prime Minister.

(ii) Conducting advance security liaison and coordination for VIP movements.

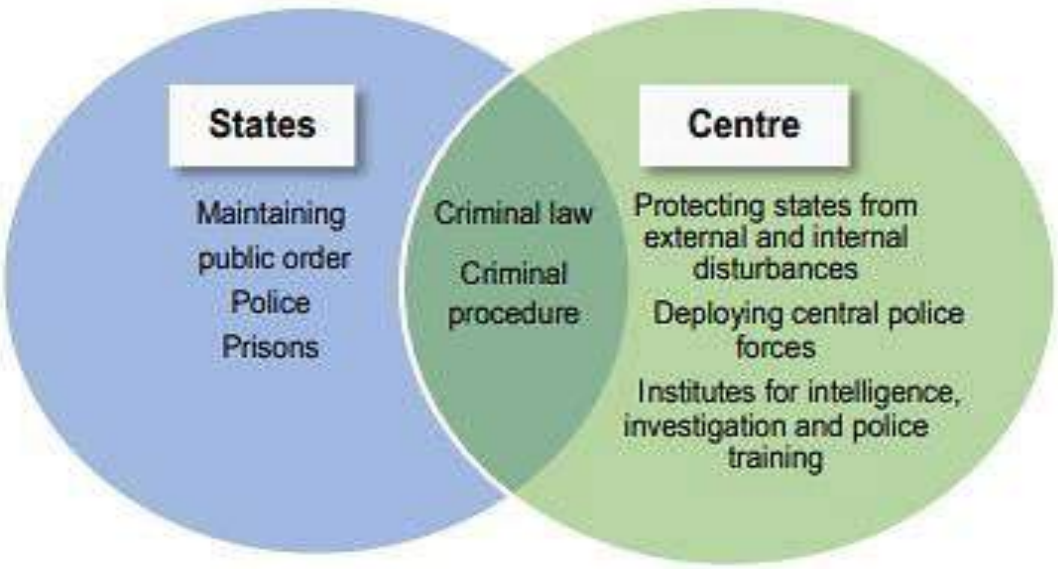
(iii) Providing close protection and security to PM during public appearances and events.

29. These agencies work in coordination with each other and with other law enforcement bodies to ensure a comprehensive approach to national security and law enforcement.

PART IV - ROLE AND TASK OF STATE POLICE

30. State Police forces are the primary law enforcement agencies within their respective states, responsible for maintaining law and order, preventing and investigating crimes and ensuring public safety. Here's a brief overview of their key roles and Tasks.

RESPONSIBILITIES OF CENTRE AND STATES WITH REGARD TO POLICE



31. **Crime Prevention and Investigation**.

(a) **Primary Role**. Preventing and investigating crimes within the state.

(b) **Tasks**.

(i) Patrolling communities to deter criminal activities.

(ii) Investigating crimes such as theft, assault and homicide.

(iii) Collecting evidence, interviewing witnesses and apprehending suspects.

(iv) Collaborating with other law enforcement agencies for complex investigations.

32. **Traffic Management**.

(a) **Primary Role**. Ensuring the safety and smooth flow of traffic on state roads and highways.

(b) **Tasks**.

(i) Enforcing traffic laws and regulations.

(ii) Conducting sobriety checkpoints and addressing impaired driving.

(iii) Investigating traffic accidents and providing assistance to motorists.

33. Managing traffic during special events and emergencies.

Control Room of a Police Headquarters

34. **Public Order Maintenance**.

(a) **Primary Role**. Maintaining public order and safety during events and emergencies.

(b) **Tasks**.

(i) Managing crowds during public events, protests and demonstrations.

(ii) Responding to emergencies such as natural disasters, fires and accidents.

(iii) Providing security during elections and other significant public gatherings.

(iv) Assisting in disaster response and relief operations.

Police during Crime Investigation

35. **Community Policing**.

(a) **Primary Role**. Building trust and cooperation between the police and the community.

(b) **Tasks**.

(i) Engaging with community members to address local issues and concerns.

(ii) Conducting public awareness programs on crime prevention and safety.

(iii) Establishing neighbourhood watch programs and other community initiatives.

(iv) Working with schools, businesses and other organizations to enhance public safety.

36. **Specialized Units**.

(a) **Primary Role**. Addressing specific types of crimes and emergencies.

(b) **Tasks**.

(i) Operating specialised units such as SWAT, cybercrime and narcotics teams.

(ii) Conducting operations to combat organized crime, drug trafficking and terrorism.

(iii) Providing technical and forensic support for investigations.

(iv) Engaging in search and rescue missions and other specialized tasks.

37. State Police forces play a crucial role in ensuring the safety and security of their communities. By performing these diverse tasks, they help maintain law and order, prevent crime and respond effectively to emergencies. This overview builds on the previous chapter's discussion of the structure and responsibilities of the State Police forces, providing a comprehensive understanding of their operational dynamics.

Deputy Superintendents of UP Police with CM during the passing out parade ceremony at Dr. Bhimrao Ambedkar Police Academy

PART V: TRAINING OF POLICE, STATE POLICE AND CAPF

38. **Central Armed Police Forces (CAPF)**.

(a) **Sardar Vallabhbhai Patel National Police Academy (SVPNPA)**. Located in Hyderabad, this academy trains Indian Police Service (IPS) officers who often lead CAPF units.

(b) **Central Training Institutes (CTIs)**. Each CAPF has its own training institutes, such as:-

(i) **Border Security Force (BSF)**. BSF Academy in Tekanpur, Madhya Pradesh.

(ii) **Central Reserve Police Force (CRPF)**. CRPF Academy in Gurugram, Haryana.

(iii) **Indo-Tibetan Border Police (ITBP)**. ITBP Academy in Mussoorie, Uttarakhand.

(iv) **Central Industrial Security Force (CISF)**. CISF National Industrial Security Academy (NISA) in Hyderabad andhra Pradesh.

(v) **Sashastra Seema Bal (SSB)**. SSB Academy in Bhopal, Madhya Pradesh.

(vi) **National Security Guard (NSG)**. NSG Training Centre in Manesar, Haryana.

(vii) **Assam Rifles**. Assam Rifles Training Centre and School in Dimapur, Nagaland.

Sardar Vallabhbhai Patel National Police Academy (SVPNPA), Hyderabad

39. **State Police Forces**.

(a) **State Police Academies**. Each state has its own police academy for training state police officers. Examples include:

(i) Dr BR Ambedkar Police Academy, Moradabad
(ii) Maharashtra Police Academy, Nashik.
(iii) Tamil Nadu Police Academy, Chennai.
(iv) Rajasthan Police Academy, Jaipur.

(b) **District Training Centres**. These centres provide training to constables and other lower-rank officers within the state.

(c) **Specialised Training Centres**. For specific skills such as cybercrime, forensic science and traffic management.

40. **Central Police Organizations (CPOs)**.

(a) **National Institute of Criminology and Forensic Science (NICFS)**. Located in Delhi, it provides training in criminology and forensic science.

(b) **Central Bureau of Investigation (CBI) Academy**. Located in Ghaziabad, Uttar Pradesh, it trains CBI officers.

(c) **Intelligence Bureau (IB) Training School**. Located in Shivpuri, Madhya Pradesh, it trains IB officers.

(d) **National Investigation Agency (NIA) Training Centre**. Located in Hyderabad, it trains NIA officers.

41. These training institutions ensure that personnel from the CAPF, State Police and various CPOs are well-prepared to handle their respective roles and responsibilities effectively.

CONCLUSION

42. The Central Armed Police Forces (CAPF) and State Police forces are indispensable to India's security framework, each playing distinct yet complementary roles. The CAPF, comprising units like the BSF, CRPF, CISF, ITBP, SSB, Assam Rifles and NSG, is tasked with a wide range of responsibilities from border security and counter-insurgency to protecting critical infrastructure and responding to disasters. These forces are trained in specialized institutions to handle their unique operational demands effectively.

43. State Police forces, on the other hand, are the primary law enforcement agencies within their respective states. They focus on maintaining law and order, preventing and investigating crimes, managing traffic and engaging in community policing. Their training is conducted in state-specific academies and district training centres, ensuring they are well-prepared to address local security challenges.

44. Central Police Organizations (CPOs) like the CBI, IB, NIA and others play crucial roles in intelligence gathering, investigating high-profile crimes and enforcing economic laws. These agencies work in close coordination with CAPF and State Police forces, sharing intelligence, conducting joint operations and providing technical support to ensure a comprehensive approach to national security.

45. In summary, the CAPF, State Police and CPOs collectively contribute to a robust security apparatus that safeguards the nation from internal and external threats. Their coordinated efforts and specialized training ensure that they are well-equipped to handle a wide range of security challenges, maintaining peace and stability across the country. This chapter has provided a detailed understanding of their roles, tasks and the importance of their collaboration in ensuring India's security.

SUMMARY

- The CAPF and State Police forces are essential for maintaining internal security and law and order in India.
- CAPF includes forces like BSF, CRPF, CISF, ITBP, SSB, Assam Rifles and NSG.
- **Assam Rifles (AR)**. Border security and counter-insurgency in Northeast India.
- **Border Security Force (BSF)**. Guarding borders with Pakistan and Bangladesh, preventing trans-border crimes.
- **Central Industrial Security Force (CISF)**. Securing critical infrastructure like airports and nuclear plants.

- **Indo-Tibetan Border Police (ITBP)**. Guarding the Indo-China border, high-altitude operations.
- **National Security Guard (NSG)**. Counter-terrorism and hostage rescue.
- **Sashastra Seema Bal (SSB)**. Guarding borders with Nepal and Bhutan, disaster management.
- **Bureau of Police Research and Development (BPR&D)**. Modernising police forces, research and training.
- **Central Bureau of Investigation (CBI)**. Investigating high-profile crimes, corruption and economic offenses.
- **National Crime Records Bureau (NCRB)**. Collecting and analysing crime data.
- **National Institute of Criminology and Forensic Science (NICFS)**. Education and training in criminology and forensic science.
- **National Investigation Agency (NIA)**. Investigating terrorism and national
  - Directorate of Enforcement (ED). Enforcing economic laws and fighting financial crimes.
  - National Disaster Response Force (NDRF). Specialized response during disasters.
  - Central Economic Intelligence Bureau (CEIB). Coordinating economic intelligence.
  - Directorate General of Revenue Intelligence (DGRI). Combating smuggling and customs fraud.
  - Financial Intelligence Unit - India (FIU-IND). Combating money laundering and terrorist financing.
  - Directorate General of Anti-Evasion (DGAE). Preventing tax evasion.
  - Directorate General of Income Tax Investigation (DGIT). Investigating income tax evasion.
  - National Technical Research Organisation (NTRO) Technical intelligence gathering.
  - Research and Analysis Wing (RAW). External intelligence gathering.
  - Aviation Research Centre (ARC). Aerial surveillance and reconnaissance.
  - Special Protection Group (SPG). Security for the Prime Minister and high- risk VIPs.
  - CAPF Training. Specialized institutions like BSF Academy, CRPF Academy, ITBP Academy, CISF NISA and NSG Training Centre.
  - State Police Training. State-specific academies and district training centres.
  - CPO Training. Institutions like CBI Academy, IB Training School and NIA Training Centre.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Which CAPF unit is primarily responsible for guarding the Indo-Myanmar border?

(a) BSF
(b) CRPF
(c) Assam Rifles
(d) ITBP

Q2. What is the primary role of the Central Industrial Security Force (CISF)?

(a) Border security
(b) Counter-insurgency
(c) Industrial security
(d) Traffic management

Q3. Which force is known as the “First Line of Defence” of Indian territories?

(a) CRPF
(b) BSF
(c) ITBP
(d) NSG

Q4. The National Security Guard (NSG) is specialized in which type of operations?

(a) Border security
(b) Counter-terrorism and hostage rescue
(c) Industrial security
(d) Traffic management

Q5. Which CAPF unit is tasked with anti-Naxal operations?

(a) BSF
(b) CISF
(c) CRPF
(d) ITBP

Q6. What is the primary role of the Intelligence Bureau (IB)?

(a) External intelligence gathering
(b) Internal intelligence gathering
(c) Border security
(d) Industrial security

Q7. Which agency is responsible for combating drug trafficking and abuse?

(a) CBI
(b) NCB
(c) ED
(d) NIA

Q8. The National Disaster Response Force (NDRF) is specialized in.

(a) Counter-terrorism
(b) Disaster response
(c) Border security
(d) Industrial security

Q9. Which agency is tasked with investigating high-profile and complex criminal cases?

(a) IB
(b) CBI
(c) NIA
(d) RAW

Q10. The Sashastra Seema Bal (SSB) guards India's borders with:

(a) Pakistan and China
(b) Nepal and Bhutan
(c) Bangladesh and Myanmar
(d) Sri Lanka and Maldives

Q11. Which force is responsible for securing airports and seaports in India?

(a) CRPF
(b) CISF
(c) BSF
(d) ITBP

Q12. The Central Reserve Police Force (CRPF) assists in maintaining law and order during.

(a) Elections
(b) Natural disasters
(c) Border conflicts
(d) Industrial strikes

Q13. Which agency is responsible for enforcing economic laws and fighting financial crimes?

(a) NCB
(b) ED
(c) CBI
(d) NIA

Q14. The Indo-Tibetan Border Police (ITBP) is primarily tasked with.

(a) Guarding the Indo-China border
(b) Counter-insurgency in Northeast India
(c) Industrial security
(d) Anti-Naxal operations

Q15. Which agency provides security to the Prime Minister and other high-risk VIPs?

(a) NSG
(b) SPG
(c) CRPF
(d) CISF

Short Answer Type Questions

Q1. What are the primary roles of the Border Security Force (BSF)?

Q2. Describe the main tasks of the Central Industrial Security Force (CISF).

Q3. What is the role of the National Investigation Agency (NIA)?

Q4. How does the Intelligence Bureau (IB) contribute to national security?

Q5. What are the responsibilities of the National Disaster Response Force (NDRF)?

Long Answer Type Questions

Q1. Discuss the various roles and tasks of the Central Reserve Police Force (CRPF) in maintaining internal security.

Q2. Explain the coordination between CAPF units and State Police forces in ensuring law and order.

Q3. Describe the training process for CAPF personnel and its importance in their operational effectiveness.

Q4. Analyse the role of the Narcotics Control Bureau (NCB) in combating drug trafficking and abuse.

Q5. Evaluate the significance of the Special Protection Group (SPG) in providing security to high-risk VIPs.

FIELD CRAFT

BATTLE CRAFT

2

CHAPTERWISE INDEX: FIELD CRAFT AND BATTLE CRAFT

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-I: INTRODUCTION TO FIELD CRAFT AND BATTLE CRAFT

"If you know heaven and earth, you may make your victory complete."

TEACHING INSTRUCTIONS

Period	**:**	**03 (120 Mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Precis Lesson plan, Board & markers and Open training area for practical classes/ Practice.

Time Plan

➢ **Introduction**	**:**	**02 Mins**
➢ **Part I**	**:**	**10 Mins**
➢ **Part II**	**:**	**28 Mins**
➢ **Part III**	**:**	**17 Mins**
➢ **Part IV**	**:**	**20 Mins**
➢ **Conclusion**	**:**	**03 Mins**
➢ **Practice**	**:**	**40 Mins**

INTRODUCTION

1. In view of the multifaceted expectations and contribution that is expected/ assigned to cadets during peace, war or emergency situation, Battle Craft (BC) & Field Craft (FC) has a non-negotiable role in explaining nature of ground, means to advance towards target and finally accomplishing the allotted task. During war like situation the importance of BC/FC increases manifolds, because locating the target correctly, informing the locations to the forward elements and engaging the targets becomes of paramount importance. Similarly locating people during natural calamities and selecting the most favorable route of saving them also demands correct identification of landmarks.

INTERESTING FACTS

- **The art of field craft and battle craft dates back to the ancient times when it was used for food and survival**.

- **Pathani Samanta the great astronomer and mathematician who hails from Odisha could measure distance using bamboo pipe & traditional instruments**. **He could also measure the distance between earth & Sun & other stars by using one bamboo pipe & two wooden sticks**.

PREVIEW

The lecture will be conducted in following parts:-

- **Part I: Terminologies used**.
- **Part II: Field Craft, Battle Craft & Practice**.
- **Part III: Method of Judging Distance & Practice**.
- **Part IV: Types of Ground, Identification of Landmarks & Practice**.

LEARNING OBJECTIVES

- **Familiarizing cadets with FC and BC**.
- **Role of FC, BC**.
- **Various subjects that come under FC, BC**.
- **Means to Judging Distance**.
- **Methods of Judging Distance**.
- **Practice on Ground**.

PART I: TERMINOLOGIES USED

2. **Terminologies used**. In this part the cadets shall study the various terms and definitions that will be used during the course of the chapter.

(a) **Landmarks**. A natural or artificial object on the ground which is used for the verbal orders irrespective of whether its present on map or not.

(b) **Reference Point**. An important and unmistakable object, with the help of which you can indicate other landmarks and targets. A reference point should be specific and if more than one degree in expansion, corners can be taken as reference.

(c) **Target**. It is an object having technical significance which is indicated with a view to bring down fire on it. In case of natural calamities this will be the place where we are expected to give our support.

(d) **Ground**. It is the area available for accomplishing the main task.

(e) **GRAD**. To be explained through examples:

G	**Group**	The affected team for the task
R	**Range**	Distance of Object from own location
A	**Aid**	Assistance taken to describe the target
D	**Description**	Description of the target

(f) **Field Signals**. Methods used by the team commander to explain the target & methods to accomplish task allotted to his team.

(g) **Formation**. The ways and means adopted by an Infantry section to advance towards the target.

(h) **Fire Control Orders**. Orders given by the team commander to engage designated targets.

(i) **Camouflage & Concealment**. Act of hiding & surprising the enemy and engaging him without disclosing own whereabouts.

PART II: FC & BC

3. Field Craft (FC) is the skill of using the ground and the weapon to the best of one's own advantage. Whereas Battle Craft (BC) is a set of drills which are essential for the conduct of successful tactical movement or operations in the (battlefield). So whilst FC can be practiced by a trained person singularly or convectively, BC is a collective action by a group of trained personnel like a section or a platoon.

4. FC is an essential stepping stone of soldiering. It involves mastering multiple techniques and processes such as camouflage, concealment, estimating distance, etc., so that a soldier can exploit any situation to his advantage. These are:-

(a) **Visual Training**. Developing the ability to quickly and accurately identify targets.

(b) **Camouflage and Concealment**. Using natural and artificial materials to blend into the environment and avoid detection.

(c) **Judging Distance**. Accurately estimating the distance to targets for effective engagement.

(d) **Movement Techniques**. Utilizing terrain and cover to move safely with or without arms.

(e) **Field Signals**. Using hand and arm signals, with or without sound, to communicate with other soldiers.

(f) **Recognition and Description of Targets**. After acquiring visual training skills, soldiers learn to recognise targets both on the ground and on maps, and to accurately describe them to others. This ensures that targets are clearly understood without error or confusion.

5. **Movement Techniques**. During war it is imperative for everyone to advance towards the target/object without being detected. Various methods of advancing towards the object can be crawling, rolling, side rolling with or without arms. Same will be demonstrated during practice.

MOVEMENT WITHOUT ARMS	MOVEMENT WITH ARMS
The Monkey Run	The Ghost Walk
The Leopard crawl	The Monkey Run
The Walk	The Leopard crawl
The Roll	The Moderate Walk
Crawl through abdomen	The Roll
The Kitten Crawl	
The Cat Walk	

THE CAT WALK

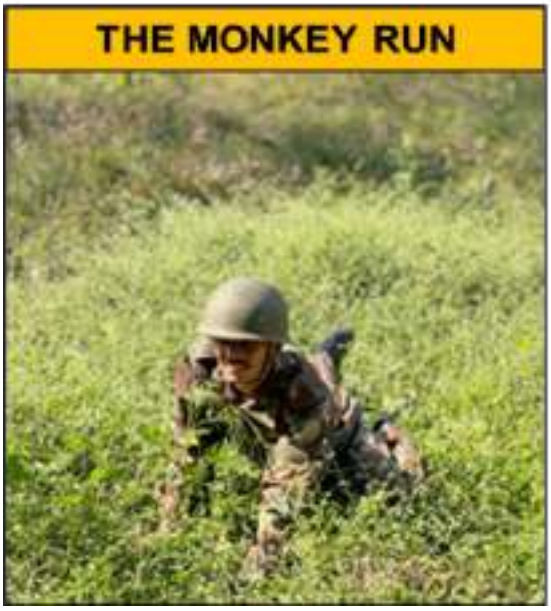
THE GHOST WALK

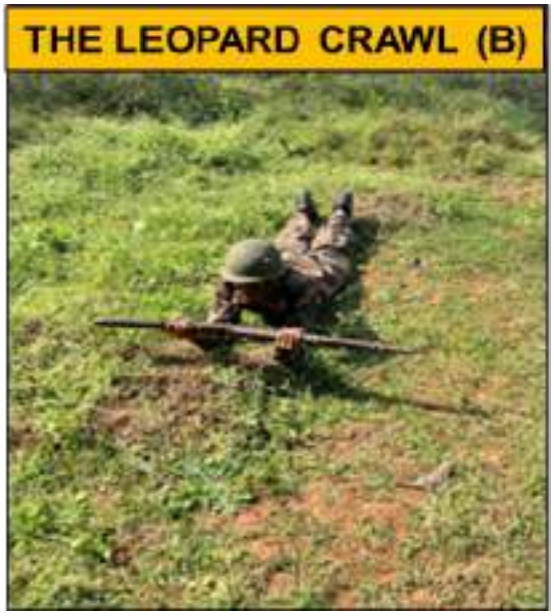
THE ROLL WITH WEAPON

THE ROLL WITHOUT WEAPON

CRAWL THROUGH ABDOMEN

THE LEOPARD CRAWL (A)





6. **Battle Craft**. Battlecraft set of drills which are essential for conduct of successful operations in the battlefield. These battle drills are very useful in tackling minor tactical problems. They save time, ensure rapid action and avoid confusion. Knowledge of field signals and section and platoon formations, however is essential in the execution of various battle drills. Battle craft includes the following subjects:-

(a) **Field Signals**. Sometimes in the battle field, there is a need for a complete silence. Then “signals” are applied in place of verbal communications.

(b) **Section Formations**. A section is a small military unit consisting of 10 personnel. Formations used when Section comes in contact with the enemy is called Section Formation.

(c) **Fire Control Orders**. Fire Control orders are a set of instructions given to soldiers to help them identify and shoot a target. Fire control orders are given in a specific sequence and soldiers should know how to respond to them. It is a specific command given by a fire unit leader to direct their troops on exactly where and how to engage a target, including details like range, type of fire, and target indication allowing for precise and coordinated firepower.

(d) **Fire and Move**. Fire and move, also known as fire and maneuver, is a military tactic that involves movement of troops while using fire to suppress the enemy. It is used to advance on enemy positions or disengage from them.

(e) **Fire Discipline**. Fire Discipline refers to the established system of words, phrases, rules and conventions used in military and emergency response contexts to ensure precise, efficient, and timely action. In military context, Fire Discipline is a standardized vocabulary and set of conventions for directing fire of artillery guns and other weaponry. The goal of same is to ensure that commands are understood with precision, eliminating ambiguity and confusion, and leading to immediate and accurate action at the guns. The system includes initial calls for fire, target

descriptions, adjustment orders and commands for fire for effect, all delivered in a specific sequence. Fire Discipline assures orderly operations, maximises safety and leads to successful outcome on fireground.

(f) **Section Battle Drills**. Section battle drill is a military drill that involves preparation, reacting to enemy fire, and regrouping.

PART III: JUDGING DISTANCE & METHODS

7. Judging the correct distance helps to effectively engage any target during war. Major factors that affect Judging Distance are:-

(a) Nature of ground.
(b) Experience of observer.
(c) Ambient light.
(d) Intervisibility of objects.
(e) Weather conditions.

8. Accurate fire with any weapon depends on the correct judging of distance. Although a soldier is not normally required to open fire at range over 300 meters, he must be able to judge distance up to about 1000 meters, so that it distance enables the following:-

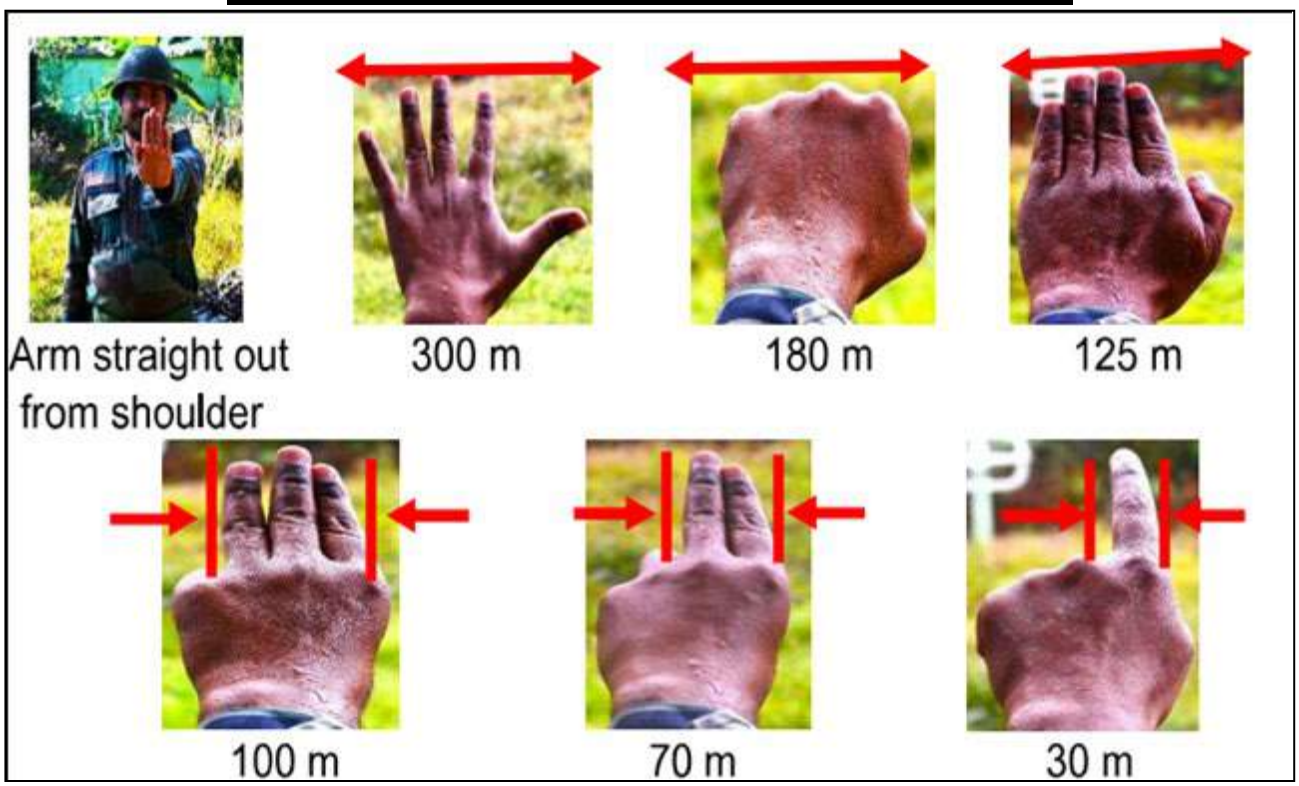
(a) To know when to open fire.

(b) To know which weapon to be used.

(c) Can indicate targets to other men in his section.

(d) Pass back accurate information when acting as an observer.

JUDGING DISTANCE BY HAND AT ONE KM (1000 M)



Methods of Judging Distance

9. The following are the six methods of judging distance:

(a) Unit of Measure.

(b) Appearance method.

(c) Section average.

(d) Key range.

(e) Halving.

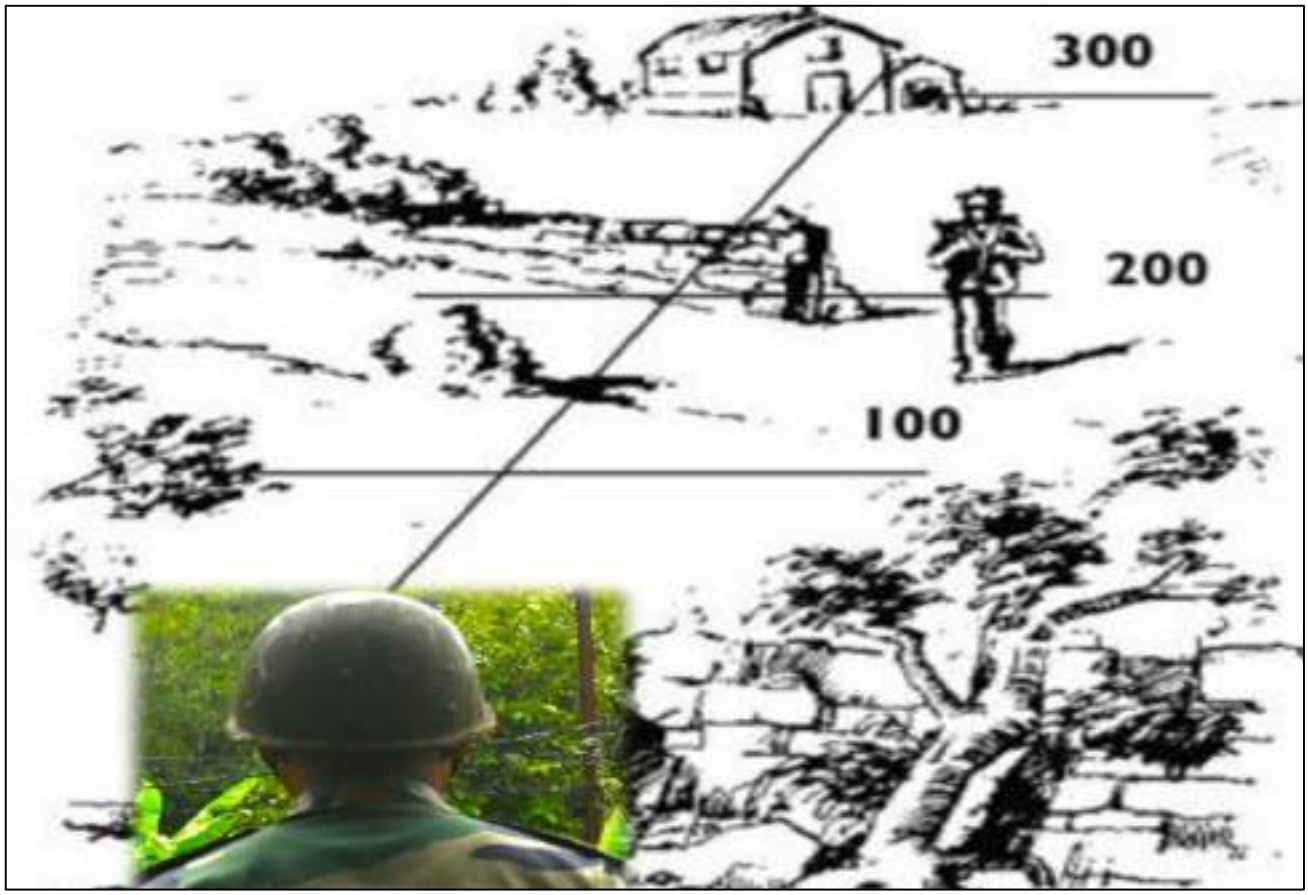
(f) Bracketing.

10. **Unit of Measure Method**. This method is also termed as the 100 meters method. The unit of measure chosen is normally 100 meters and therefore one should form a good idea of 100 meters distance on the ground. The length of a hockey field is the best yard stick for this purpose.

11. The distance of a given object will be a multiple of the imaginary unit of 100 meters, as placed between the observer and the object.

12. This method is not accurate above 100 meters and is of little use if there is dead ground between the observer and the object.

UNIT OF MEASURE METHOD`



13. **Appearance Method**. The distance can be judged by noting the detailed appearance of man at various ranges. This is the best method under service conditions. The following is a guideline to judging distance by this method:-

(a) At 200 meters, all parts of the body are distinct.

(b) At 250 meters, blade of the foresight covers a kneeling man.

(c) At 300 meters, the face becomes blurred.

(d) At 400 meters, the body remains same in shape but face is difficult to distinguish. Blade of the foresight covers a standing man.

(e) At 500 meters, body appears to taper slightly from the shoulder but movement of limbs can still be seen.

(f) At 600 meters, head appears as a dot. Details are not visible and body tapers from shoulders downwards noticeably.

APPEARANCE METHOD

At 100 m – clear in all details.

At 200 m – clear in all details, color of skin and equipment identifiable.

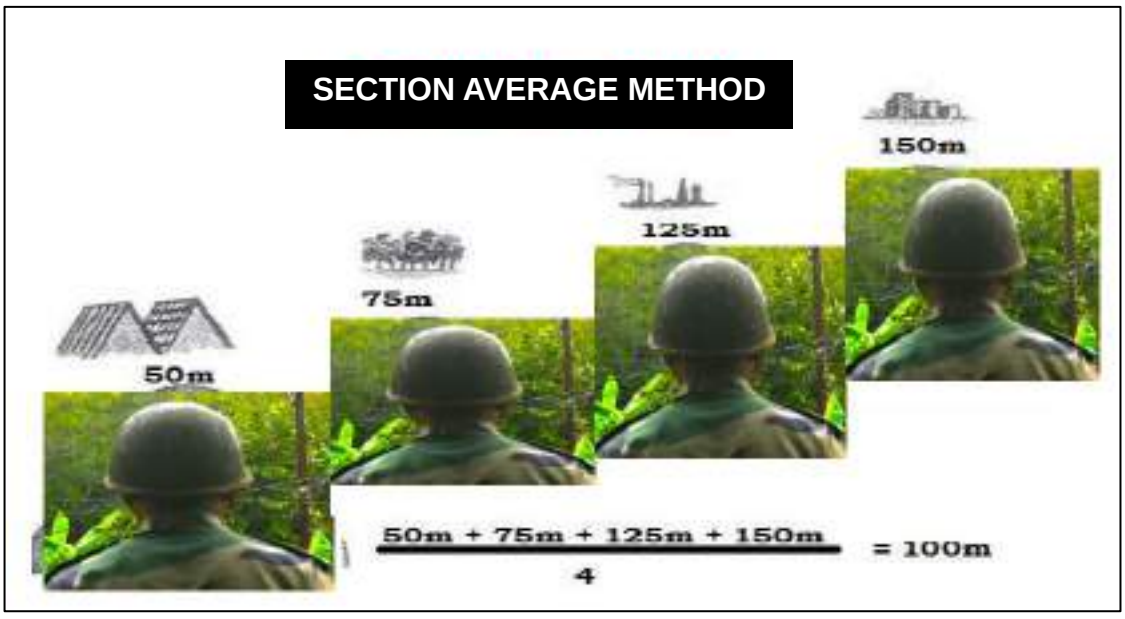
At 300 m – clear body outline, face color visible, remaining details blurred.

14. **<u>Section Average Method</u>**. Each man in the section is asked to judge the distance of a given object. The average of the answers given by the whole section is then accepted as the distance of the target from the observer. Here caution must be exercised in the estimation of a few who may foolishly overestimate/ underestimate the distance. This method may be resorted to under the following circumstances:-

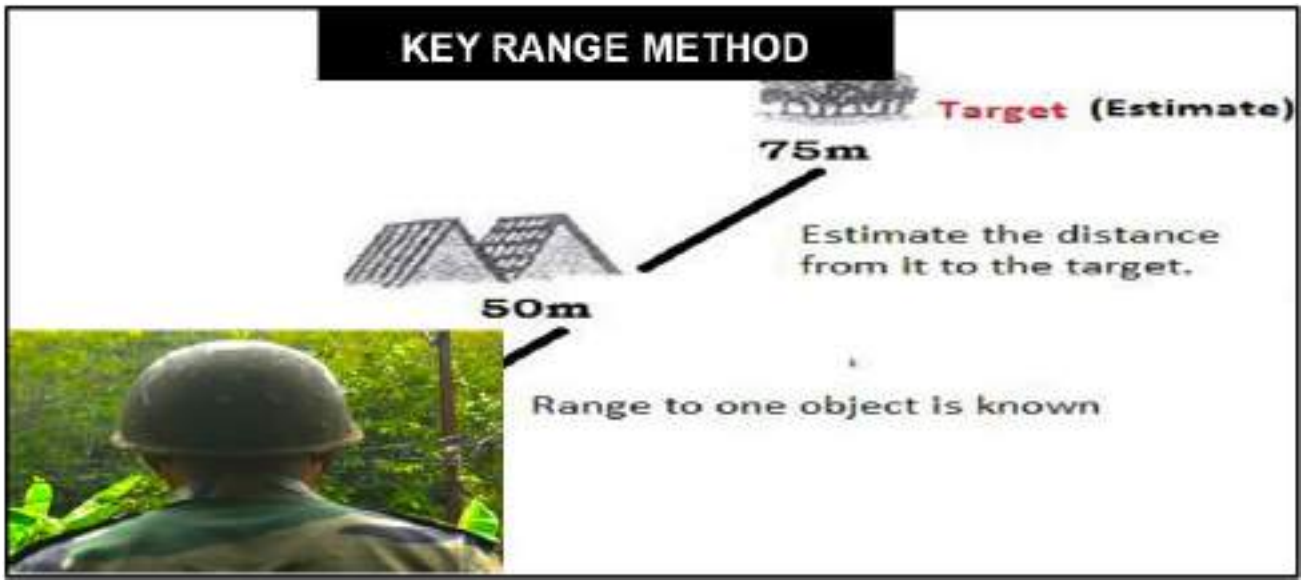
(a) Ample time is available.

(b) Judging of distance is made difficult by mist or darkness.

(c) Judging of a long distance is involved e.g. beyond 400 meters.



15. **Key Range Method**. If the range of the certain object is known, distance to other objects can be found in relation to the known range. This method is called 'Key Range' method.



16. **Halving Method**. Halving Method entails that an object is selected halfway between the observer and the target, the distance to the selected object is judged and doubled to get the distance to the target.

17. **Bracketing Method**. The observer works out the maximum and the minimum possible distance of the object and then accept the mean as the distance e.g. maximum possible distance 1000 meters, minimum possible distance 500 meters therefore estimated range is 750 meters. The greater the range, wider the bracket. In no case the bracket should be less than 300 meters.

DID YOU KNOW?

- Field Craft and battle Craft procedures are enormously affected by the terrain and weather conditions.
- Correct Judging of distance assists you in a big way in your day- to – day activities as well.
- Learning to trust your compass and night navigational aids also play a vital role in FC & BC.
- Distance up to 300 m is called near distance, Distance between 300 - 500 m is called middle distance and distance beyond 500 m is called far distance.

Practical Hints

18. **During Day**. During the day judging distance will depend on the inter visibility of observer and the object. Therefore, whilst judging the distance, the aspect which leads to over estimation or under estimation of distances should be kept in mind. A combination of 'Key Range method' with another suitable method should be used in arriving at the best

answer. In addition to this, comparative appearance of a known object with generally standard dimensions like a stationary car, a regular sized door, corridor of a building at various distances can facilitate in judging the distance of the object. For distances of about 300m or lesser, Thumb method can also be used. This works on the principle that the approximate ratio of the arm length and interpupillary distance (distance between eyes) when the arm is outstretched is 10 times. The process involves extending your arm, closing one eye, aligning your thumb with the object. Now switch eyes, you would notice the apparent movement of the thumb. Multiplying the apparent shift of thumb from the edge of the object by 10 will give you the actual distance.

19. **During Night**. During night and hours of poor visibility, judging distances with naked eyes becomes a very challenging process. At night the visibility will be governed by ambient light and phases of moon, as well as topography, viz. on a snow covered or plain desert, visibility is significant during full moon phase at night. Apart from this, as surroundings become darker, the distances start to appear bigger. An observer can keep in mind certain very large objects with identifiable silhouettes, distance of which is known, like a multi storied building or a tree, and use them to identify the distance of other objects at night. A sound of an object can also give a perception of the approximate distance of the object. An observer must keep all the above mentioned factors in mind, and should commence his or her observations at night by carrying out low light adaptation drill for about 20–30 minutes in which the eyes get accustomed to dusk/night situation.

20. Distances are wrongly estimated under following conditions:-

(a) **Distance is over estimated when**.

(i) Light is bad.

(ii) The sun is in the observer's eye.

(iii) The object is small in relation to its surroundings.

(iv) Looking through valley of narrow land e.g. street.

(v) Lying down.

(b) **Distance is under estimated when**.

(i) The light is bright or the sun is shining from behind the observer.

(ii) The object is large in relation to its surrounding.

(iii) There is some dead ground between observer and the object Looking uphill.

PART IV: TYPES OF GROUND & IDENTIFICATION OF LANDMARKS

21. A standard, quick and accurate procedure is necessary to enable commander to describe an area to his men quickly and the men to understand it correctly and vice versa.

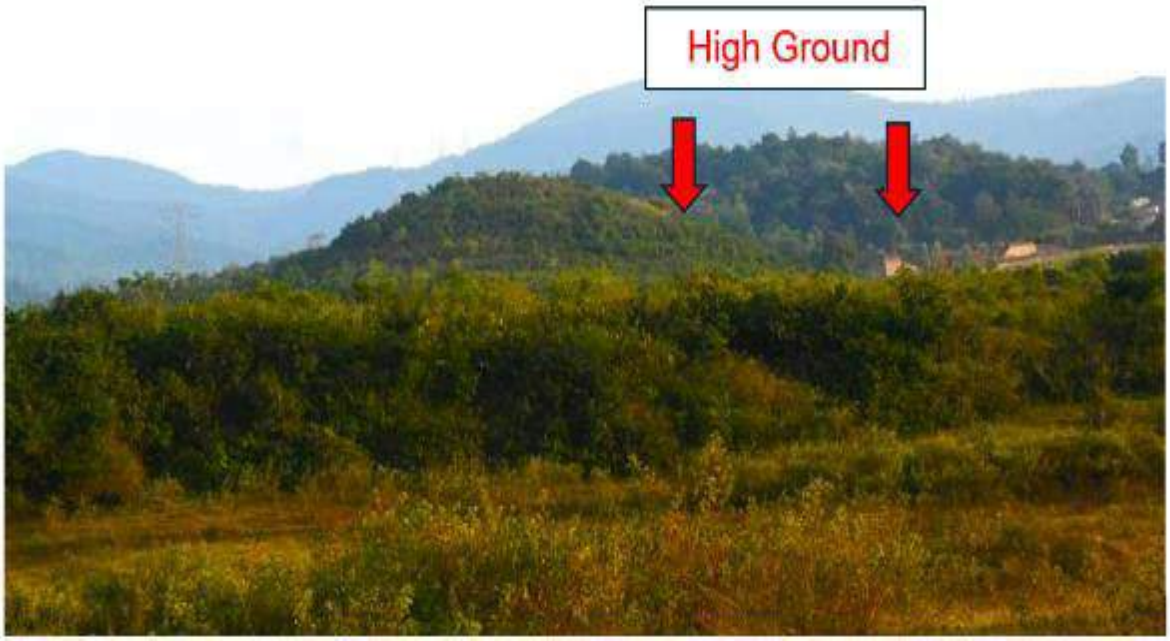
Definition

22. There are four types of ground:-

(a) **Broken Ground**. It is uneven and is generally interspersed with nullahs, bump sand field in the ground. It is suitable for move of infantry and hinders observation of activities.

(b) **Flat and Open Ground**. It is even ground with little cover eg. bushes, hedges and similar foliage. It is not suitable for move of Infantry by day.

(c) **<u>High Ground</u>**. Ground far above the general level of the area e.g. hill. It facilitates domination of area around it by observation or fire or both.



(d) **<u>Dead Ground</u>**. Ground that is hidden from an observer's view. It cannot be covered by flat trajectory weapons

23. The following points should be remembered about various types of ground:-

(a) Though an open ground is easy to travel, it is dangerous to do so in the vicinity of the enemy. Whether moving or taking fire position in an open area one is vulnerable to enemy from view and fire.

(b) Broken ground when correctly used affords protection from flat trajectory weapons. It does not afford cover from air or protection from high trajectory weapons.

(c) Dead ground does not afford cover from high trajectory weapons.

Procedure of Description of Ground

24. The normal method of scanning and describing ground is by dividing it as follows:-

(a) **Fore/Near Ground**. Any object / landmark up to distance of 300 meters is called Fore / Near Ground.

(b) **Middle Ground**. Any object / landmark between distance of 300 meters up to 500 meters is called Middle Ground.

(c) **Far/Distant Ground**. Any object /landmark beyond 500 meters is called Far/Distant ground.

25. After theoretical class, the cadets will be given exposure of subject practically outdoor. The practice will include the following:-

(a) Movement with & without arms.

(b) Various methods using arm to judge distance.

(c) Practice of using various methods of judging distance using natural resources.

(d) Practice of judging distance during night.

26. **Identification of Landmarks**. Points to keep in mind while identifying landmark are as follows:-

(a) It should be prominent.

(b) It should be static in nature.

27. The following points should be remembered about various types of ground:-

(a) Though an open ground is easy to travel, it is dangerous to do so in the vicinity of the enemy. Whether moving or taking fire position in an open area one invulnerable to enemy from view and fire.

(b) Broken ground when correctly used affords protection from flat trajectory weapons. It does not afford cover from air or protection from high trajectory weapons.

(c) Dead ground does not afford cover from high trajectory weapons.

PART V: PRACTICE

28. After theoretical class, the cadets will be given exposure of subject practically outdoor. The practice will include the following:-

(e) Movement with & without arms.

(f) Various methods using arm to judge distance.

(g) Practice of using various methods of judging distance using natural resources.

(h) Practice of judging distance during night.

CONCLUSION

29. To achieve success in war it is very important that the target is correctly understood alongwith mechanics of field and battle crafts. Knowledge of ground along with basic skills would be beneficial to cadets in all respect. Use of natural resources plays a vital role in effective execution of field craft and battle craft drills.

SUMMARY

- Field Craft include Visual Training, Recognition & Description of targets, camouflage & Concealment, Judging Distance, Move with and without Arms & fire Description and Control.
- Battle Craft include Field Signals, Section Formations, Fire Control Orders, Fire & Move and Section Battle Drills.
- There are six methods of Judging Distance.
- Ground plays a vital role in any operation of war & can be described in four major types.
- The procedure of describing ground is covered in three major phases.
- Accuracy in Judging Distance during day as well as night demands immense practice.
- Field Signals are effective ways of correctly identifying the target.
- Things are seen because of Shape, Shine, Shadow, Silhouette, Speed, Smell & Surface.

ASSESSMENT EXERCISE

Multiple Choice Questions and fill in the Blanks

Q1. In the _____ you judge the distance with the help of the blade of the foresight of your weapon.

(a) Rifle Method (b) Foresight Method
(c) Blade Method (d) Appearance Method

Q2. Which of these does not fall under the Field Craft.

(a) Section Formation (b) Visual Training
(c) Judging Distance (d) Fire Control

Q3. _____ are very useful in tackling minor tactical problems.

(a) Field Signals (b) Battle Drills
(c) Field Crafts (d) Section Formations

Q4. The art of using the ground and the weapon to the best of one's own advantage is called _____.

(a) Camouflage (b) Field Signal
(c) Field Crafts (d) Battle Craft

Q5. 'Unit of Measure' method is also called '_____ meters method'.

(a) 25 (b 150
(c) 50 (d) 100

Q6. Sequence of giving fire control order is _____, _____, _____ & _____.

(a) GRIT (b TRIG
(c) RGIT (d) TIRG

Q7. Section battle drill is conducted in _____ steps.

(a) 01 (b 02
(c) 03 (d) 04

Q8. Appearance method is one of the methods for _____.

(a) Fire Control (b Concealment
(c) Judging Distance (d) Battle Craft

Q9. There are _____ types of Ground.

(a) 03 (b) 04
(c) 05 (d) 06

Q10. Drill essential for conduct of successful operation is called _____.

(a) Field Craft (b) Battle Craft
(c) Battle Drill (d) Field Signal

Q11. Object/ Landmark identified as middle distance will be _____ metres away.

(a) 75 (b) 525
(c) 195 (d) 450

Q12. Distances are overestimated when:

(a) Looking uphill (b) Dead Ground between Observer & Object

(c) Light is bad (d) Light is bright

Q13. An individual should be able to judge distance to

(a) Know when to open fire (b) Know which weapon to use
(c) Both (a) and (b) (d) To carry out section drill

Q14. Ground that is hidden from observer's view is called _____.

Q15. Bracket should not be less than _____ meters.

Short Answer Questions

Q1. Explain GRAD.
Q2. Write the methods of Judging Distance.
Q3. What are the types of ground?
Q4. What is the sequence of giving control orders?
Q5. Section Battle Drill is conducted in how many and what steps?
Q6. What is the procedure for describing ground?
Q7. What does Bracketing method of judging distance means?

Long Answer Questions

Q1. Describe FC.
Q2. How do you recognize / describe a target?
Q3. What all subjects are include in FC? Explain in details.
Q4. What all subjects are include in BC? Explain in details.
Q5. Describe Battle Craft.
Q6. Differentiate between movement without arms and movement with arms.

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-II: INDICATION OF LANDMARKS AND TARGET

"Water shapes its course according to the nature of the ground over which it flows. The soldier works out his victory in relation to the foe whom he is facing."

TEACHING INSTRUCTIONS

Period	**:**	**05 (200 Mins)**
Type Year	**:**	**1st (02 periods), 2nd (02 periods) & 3rd Year (01 period) SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Preci Lesson plan, Board & Markers and Open training area for practical classes/ Practice.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 05 Mins**
- **Part II : 30 Mins**
- **Part III : 35 Mins**
- **Conclusion : 05 Mins**
- **Practice : 120 Min (80 Mins for 2nd Yr & 40 Mins for 3rd Yr)**

INTRODUCTION

1. Landmarks and other objects on the ground or a battle field may be either unclear due to climatic conditions or other reasons. Every effort should, therefore be made to indicate their location and size carefully and accurately. To ensure quick and accurate indication by commanders and recognition by individual soldiers a standard procedure has been laid down in the Army. Even the aids to be used for indicating difficult targets have been laid down.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I: Definitions**.
- **Part II: Sequence of Description**.
- **Part III: Methods of Indication of Target**.
- **Part IV: Practice**.

INTERESTING FACTS

- **Correct Indication of Landmarks can be handy during rescue operations as well**.
- **Acquiring the target during any operations of war is directly proportional to indication of landmarks**.
- **Reference points make indication of landmarks easier**.
- **Procedures for indication of landmark varies with approximate distance of the object**.

LEARNING OBJECTIVES

- **Familiarizationwith Terminologies used and their definitions understanding**.
- **Sequence of description of Ground**.
- **Various methods used for identification & indication of targets**.

PART I: DEFINITIONS

2. **Landmarks**. An object which is important on the ground and is used in verbal orders to explain the ground in front.

3. **Target**. An object having a technical significance which is indicated with a view to bring down fire on it.

4. **Reference Point**. An important and unmistakable object, with the help of which you can indicate other landmarks or targets. A reference point should be specific.

5. Though an open ground is easy to travel, it is dangerous to do so in the locality of the enemy. Whether moving or taking fire position in an open area, one is exposed to enemy from view and fire. Broken ground when correctly used affords protection from flat path weapons. It does not afford cover from air or protection from high path weapons. Dead ground does not afford cover from high path weapons.

6. **Procedure of Description**. The normal method of scanning and describing ground is by dividing it as follows:-

(a) Distance up to 300 meters is called Fore Ground.

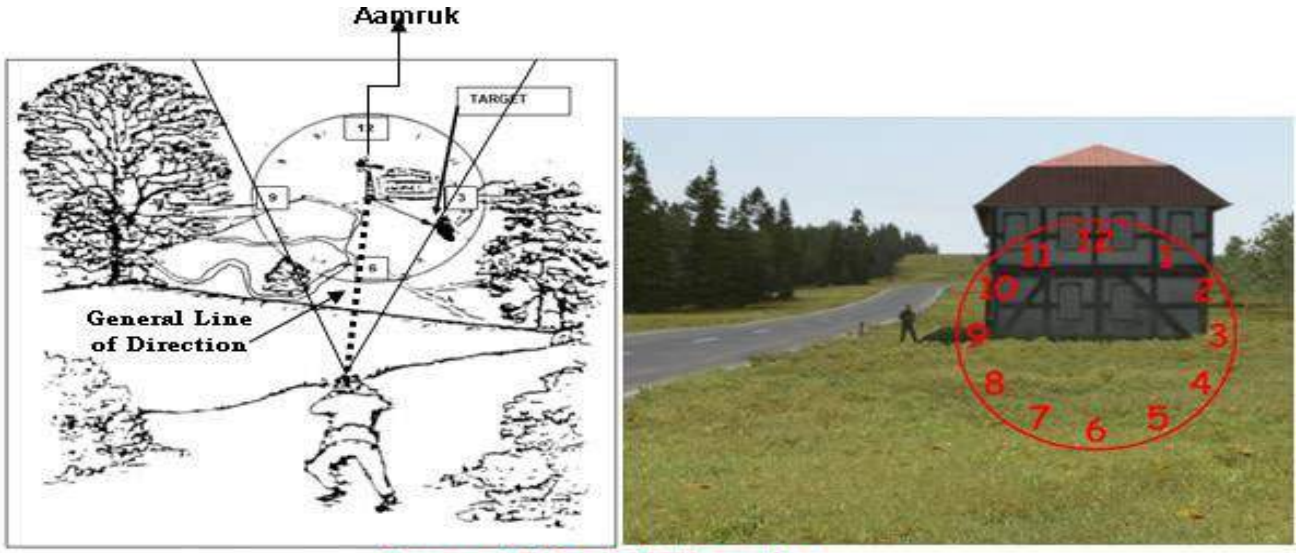
(b) Distance from 300 meters to 500 meters is called Middle Ground.

(c) Distance beyond 500 meters is called Distant Ground.

PART II: INDICATION OF LANDMARKS

7. **Sequence of description**. While describing the ground bounded by particular arc after giving the boundaries start from LEFT to RIGHT. If the ground all around is to be described, start after general line of direction to the right and finish at general line of direction by completing the indication all around.

8. **Identification of Landmarks**. Start by giving the general line of direction by pointing out a centrally located, if possible, prominent land mark, e.g. No 1 section 500 Red house, Section ka Madhya and line beyond General Line of Direction (GLD).



General Line of Direction

9. **Boundaries**. After giving general line of direction give LEFT and RIGHT boundaries of your area eg.

(a) No 1 section – aadhabaen 600 PILI JHOPRI naam JHOPRI. Section kebaen wale jawan se JHOPRI tak ki line baen had.

Aadha Dayen

Aadha Bayen

(b) Similarly indicate right boundary.

(c) Dived the ground in to foreground, middle and distance. Having done so start from LEFT to RIGHT systematically and describe.

(d) In attack describe the ground nearest to you first i.e. foreground, then middle and then distance, in defence reverse the procedure.

PART III: INDICATION OF TARGETS

Method of Indication of Easy Targets

10. **Easy Targets**. Can be indicated by the following methods:-

(a) **Indication by Description**. An obvious target can often be described directly. For example, 'No. 1 Section BRIDGE' Here BRIDGE is so obvious that nobody can make a mistake in recognizing it.

(b) **Indication by Direction or Range or Both**. In slightly less obvious cases other aids should be used e.g. direction or range or both. An example of each is given below:-

(i) **Indication by Direction**. No 1 Section BAEN BAGHICHA.

(ii) **Indication by Range**. No 1 Section 600 BAGHICHA.

(iii) **Direction and Range**. When indicting a land mark indicate direction first and then range eg BAEN-600, BAGICHA.

Indication of Difficult Targets

11. The target which cannot be indicated by the methods given above are termed difficult targets. The methods to indicate these are explained in succeeding paragraphs.

The Direction Method

12. This is used to indicate the following:-

(a) The general line of direction, or

(b) A known reference point, or

(c) Another land mark.

13. Unless otherwise stated all direction are taken to be with reference to the general line of direction. The following direction will be used:-

Direction	Measuring
Slight Left / Right	Approximately 10°
Quarter Left / Right	Approximately 22½°
Half Left / Right	Approximately 45°
Three Quarter Left / Right	Approximately 67½°
Full Left / Right	Approximately 90°

PRACTICE

14. After theoretical class, the cadets will be given exposure of subject practically outdoor. This will include identification of targets, as well as indication of easy targets and difficult targets.

CONCLUSION

15. To achieve success in war it is very important that the target is correctly understood and recognized by the troops. By using the methods of indicating the target we can easily indicate and identify the target. The accomplishment of task, can only be achieved after identification of the correct target. Hence adequate training is required to be imparted during peace time.

SUMMARY

- The Correct Sequence of indicating landmarks is Reference Point, Right or Left, Clock, Method, Degree and indication by distance.
- Easy targets can be indicated by Description or Direction or Range or both.
- Different targets can be indicated by Direction method using GLD, a known ref pt or any other landmark.
- Use of Landmarks enables effective description of targets.
- The target of grounds plays vital role in effective identification of landmarks.

ASSESSMENT EXERCISE

Multiple Choice Questions & Fill in the blanks

1. While indicating landmarks, if the ground is to be described, we must start from the _____, go around to the right and finish at the GLD.

(a) Left (b) Farthest
(c) Closest (d) GLD

2. An Object having tactical signification which is indicated with a view to bring down fire on it is called a _____.

(a) Landmark (b) Objective
(c) Target (d) Ground of Tactical Importance

3. What is full form of GLD?

(a) Group Line of Direction (b) General level of Domination
(c) General Level of Distance (d) General Line of Direction

4. During Indication of Landmarks, “Half Left’ corresponds to _____ degrees to your Left.

(a) 23 ½ (b 45
(c) 90 (d) 60

5. An important and unmistakable object, with the help of which you can indicate other landmarks or targets is called a _____.

(a) Important Landmark (b) Reference Point
(c) Man Target (d) Prime Landmark

6. Reference Point is _____

7. Quarter left or right amounts to _____ degrees approximately.

8. “No 1 Section Bridge” is _____ method of describing a target.

9. An object having a technical significance which is indicated with a view to bring down fire on it is called_____.

10. An impartial & unmistakable object with the help of which you can indicate other landmarks is called _____.

Short Answer Questions

Q1. Describe Indication of Landmarks?

Q2. What do you understand by GLD?

Q3. What is direction method?

Q4. Give examples of indication by clock & deg method?

Q5. What is a Reference Point?

Long Answer Questions

Q1. Howmany types of methods are there for indication of targets? Explain it?

Q2. Write a short note on methods of indication of targets?

Q3. Elaborate sequence of description?

Q4. Describe indication of Landmarks?

Q5. How to give General line of direction?

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-III: OBSERVATION, CAMOUFLAGE & CONCEALMENT

"If the enemy leaves a door open, you must rush in."

TEACHING INSTRUCTIONS

Period : 03 (120 Min)
Type Year : 2nd Year SD/SW
Conducting Officer : Permanent Instructor

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Precis Lesson plan, Board & markers and Open training area for practical classes/ Practice.

Time Plan

- **Introduction : 05 Min**
- **Part I : 15 Min**
- **Part II : 20 Min**
- **Part III : 30 Min**
- **Conclusion : 10 Min**
- **Practical & Training : 40 Min**

INTRODUCTION

1. Camouflage is a type of concealment or a disguise using color, materials or illumination to make an object or organism very hard to detect. Concealment on the other hand is the act of hiding or preventing something or someone from being observed or noticed.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I: Why things are seen**.
- **Part II: Personal and Equipment camouflage.**
- **Part III: Concealment**.
- **Part IV: Practical Training**.

INTERESTING FACTS

- **Camouflage comes from a French word 'Camoufler'**.
- **Snipers use camouflage and concealment to the Optimum for their own safety as well as maintaining surprises**.
- **Antiradiation paint is used on vehicles and equipment in order to achieve camouflage & concealment**.
- **Drones can be effectively used as a counter measure for camouflage and concealment**.

LEARNING OBJECTIVES

- **Familiarization with Terminologies used and under-standing their definitions**.
- **Sequence of description of Ground**.
- **Various methods used for identification & indication of targets**.

PART I: WHY THINGS ARE SEEN

2. Various factors responsible for things to be seen are as follows:-

(a) **Shape**. Not Just the overall silhouette, beware of the shapes and colors on your suit and whether they match the environment you are in. String ghillies in woodland are as bad as leaf suits in the grass. Attach elastic loops or use elastic bands to add local vegetation to help match yourself to the background.

(b) **Shine**. Anything with a smooth surface, from a plastic buckle to the rifle and pistol will give off a shine. Look closely and a lot of modern camouflages with high polyester content will have a slight sheen to them. Matt spray paint will help but in the case of the rifle, add fabric tape and other materials to hide the surfaces. Spray paint can be used to make excellent patterns and colors but still leave a very uniform flat surface that catches the light. Cover your scope with fabric and cut a hole in to see through (doesn't affect the view) to hide and glint from the lens and also to hide that giveaway black circle.

(c) **Shadow**. Use light carefully, be aware of casting shadows as you move. Move in the shadows if you can. No matter how good the camouflage, you cannot hide that big dark shape of a shadow.

(d) **Silhouette**. The human outline is very distinctive. Break it up, but also be aware of how your shape interacts with the environment. The classic example is “sky lining”, where you move across the top of a hill, outlining yourself. Move lower down, and be aware of the outline you make in the environment. Obviously, the suit will do a lot of the work for you, disguising the shape. If you are running a leaf suit, or ghillie cape or make sure to add 3 Dimensional camo to all to help break up the human outline. Also, the head and shoulders, usually on show the most, must be disguised. Utilize a big hood, and pack extra material on the sides of the head to break up the neck outline.

(e) **Smell**. Humans have a poor sense of smell and so tend to disregard this sense. Wild animals have an extremely keen sense of smell. Many hunters stalk their prey downwind so that the prey doesn’t smell them. Don’t put on aftershave or smelly deodorant. Don’t eat spicy foods and do not smoke beforehand.

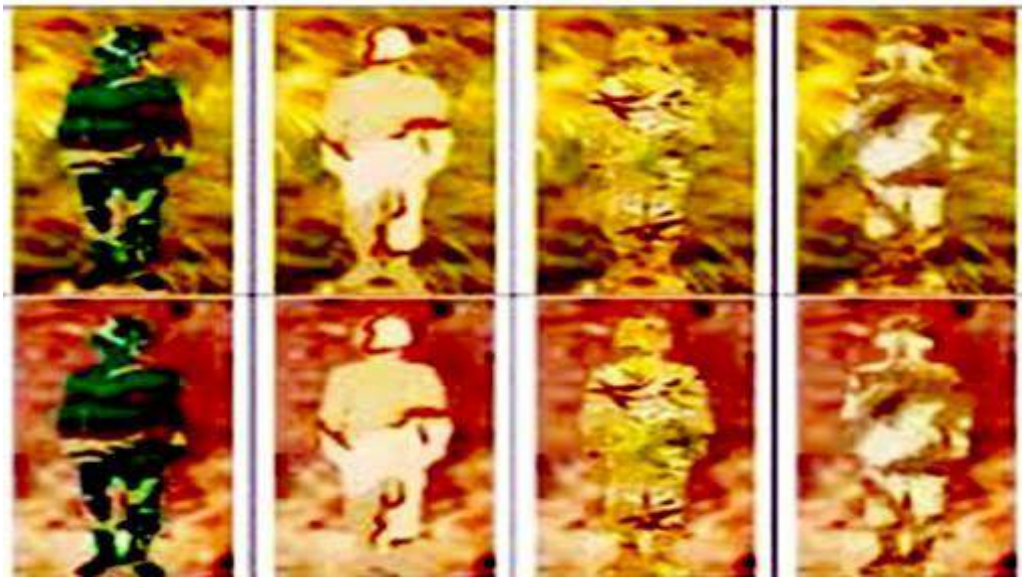
(f) **Sound**. Sound is very important on two levels. Obviously, it goes without saying that you need to minimize your own noise by taping anything loose like buckles and straps, making your rifle as quite as possible and moving quietly. When you move and you are fairly close to the enemy, then roll the foot forward on the outside the foot. This will reduce noise from footsteps. The second part of sound is being aware of noise around you.

(g) **Speed/ Movement**. Everything you do must be done slowly, unless there is an emergency. Movement is big giveaway; it’s easily spotted by your enemy. Turn your head slowly when scanning an area, change stance slowly, move your limbs slowly, move your weapon slowly and smoothly. Also make sure your suit does not interfere with anything. You don’t want to have to make any excess movement flicking raffia out of your face, or adjusting a hood. Think carefully about what kit you carry too. When selecting a fig, always make sure your load bearing sits high on the body and avoid belt setups.

PART II: PERSONAL AND EQUIPMENT CAMOUFLAGE

3. **Personal Camouflage**. Camouflage means to disguise an object in plain sight in order to conceal it from something or someone. Personal camouflage can be done by following methods:-

(a) Use of Disruptive Pattern.



(b) Clothing and Local Vegetation.

(c) Camouflage of Face.

<u>Camouflage of Equipment</u>.

4. Camouflage of Equipment:-

(a) **<u>Helmet</u>**. Use of Hessian Cloth & Use of Camouflage Net.

(b) **<u>Camouflage of Back Packs</u>**. Packs have square outline which is broken by tying thin ropes on the packs and branches of local vegetation are stuck in the ropes.

(c) **Camouflage of Rifle**. Metal parts of rifles are phosphate coated and hence shine is reduced. Garnish of suitable color should be wrapped over wooden parts / plastic parts to contrast with surroundings.

(d) **Camouflage of LMG**. Wooden/plastic parts of the LMG can be covered with garnish or a combat camouflage cloth in case it is not painted in a camouflage pattern, as shown in the picture below. The LMG trench is camouflaged using a net.

(e) **Camouflage of Dress/Web Equipment**. Equipment like dress binocular, map case, Radio Set should also be camouflaged by breaking its outline and preventing shine, shape on silhouette.

(f) **Fitting of Equipment**. Personal dress and equipment should be packed and fitted properly to avoid any unnecessary noise/tell tale signs.

PART III: CONCEALMENT

5. **Concealment**. If the enemy can see you, he can hit you with his fire. So, you must be concealed from enemy observation and have cover from enemy fire. When the terrain does not provide natural cover and concealment, you must prepare your cover and use natural and manmade materials to camouflage/ conceal yourself, your equipment and your position.

Correct Use of Cover

7. The use of various types of ground and natural cover is very essential to achieve concealment. A cadet however, skillfully camouflaged, not making correct use of cover is likely to be detected. Certain fundamentals for correct use of cover are as follows:-

(a) Whenever possible look through the cover and not over it.

(b) If it is not possible to look through the cover, look round it rather than over it.

(c) It is necessary to look over the cover, avoid breaking straight line.

(d) The sky-line is the worst background you could choose, but if you cannot avoid observing over the cover and against the sky line, use something to break your silhouette.

(e) When firing from inside a building keep well back making use of the shadow.

(f) A rough, dark and irregular background which matches your clothing, provides considerable cover from view.

(g) Isolated cover is dangerous because it will attract attention of the enemy and can be easily indicated in a fire order.

(h) Avoid skyline.

(j) Avoid regulars pacing.

(k) Avoid gaps for fire position.

(l) Cross gaps as a body and at irregular interval at the double.

DID YOU KNOW?

- Camouflage was most commonly used on guns and vehicles.
- Concealment is the most common camouflage technique.
- Each nation developed its unique camouflage pattern after the WW-II.

PRACTICE AND TRAINING

8. After theoretical class, the cadets will be given exposure of subject practically outdoor. The various materials used for camouflage & concealment like Blanco, colors, garnish will be provisioned for the cadets.

CONCLUSION

9. To conclude, the importance of camouflage and concealment can be realized from the following:-

(i) In earlier days it was said "If it can be seen, it can be hit, if it can be hit it can be killed".

(ii) But now in the modern warfare "If it can be seen it will be killed".

10. Therefore, camouflage needs greater emphasis and the art of camouflage and concealment reduces the different varieties of soldiers into two main categories viz, "The good and the dead." Concealment is an aid to tactical deception and misinforms the enemy about our intentions and strengths.

SUMMARY

- Objects are seen during day due to their Shape, Shine, Shadow, Surface, Sparing, Smoke, Sound and Movement. This can be coded as 7S
- National resources and vegetation can be effectively used for camouflage of persons as well as equipment
- Various types of cover are Cover from view, cover from fire, avoid breaking of straight line, avoid isolated cover and looking through or around cover

ASSESSMENT EXERCISE

Multiple Choice Questions & Fill in the Blanks

1. In order to camouflage a rifle, it's wooden / plastic parts should be wrapped around with _____ of suitable colour.

(a) Plastic Sheet (b) Garnish
(c) Tape (d) Paint

2. An action of misleading the enemy by concealing or misrepresenting the identity of own troops, equipment, installations and activities is called _____

(a) Tactics (b) Camouflage
(c) Isolation (d) Concealment

3. The following is not responsible for things to be seen during day.

(a) Sound (b) Light
(c) Shine (d) Smoke

4. Cover from view means _____.

5. Things are seen during night due to _____ & _____.

6. _____ is the most common camouflage tech.

7. Concealment is

(a) Concealment from enemy view
(b) Cover from enemy fire
(c) Both (a) and (b)
(d) Engage enemy with fire

8. _____ and _____ are used as a camouflage for a helmet.

9.. _____ and _____ are the two things that are visible at night.

Short Answer Questions

Q1. What is personnel Camouflage?

Q2. Write Factors responsible for things to be seen.

Q3. What all personal equipment will you camouflage before going for any Operation?

Long Answer Questions

Q1. Explain Correct use of Cover.

Q2. Give 3 new innovations for camouflage and concealment.

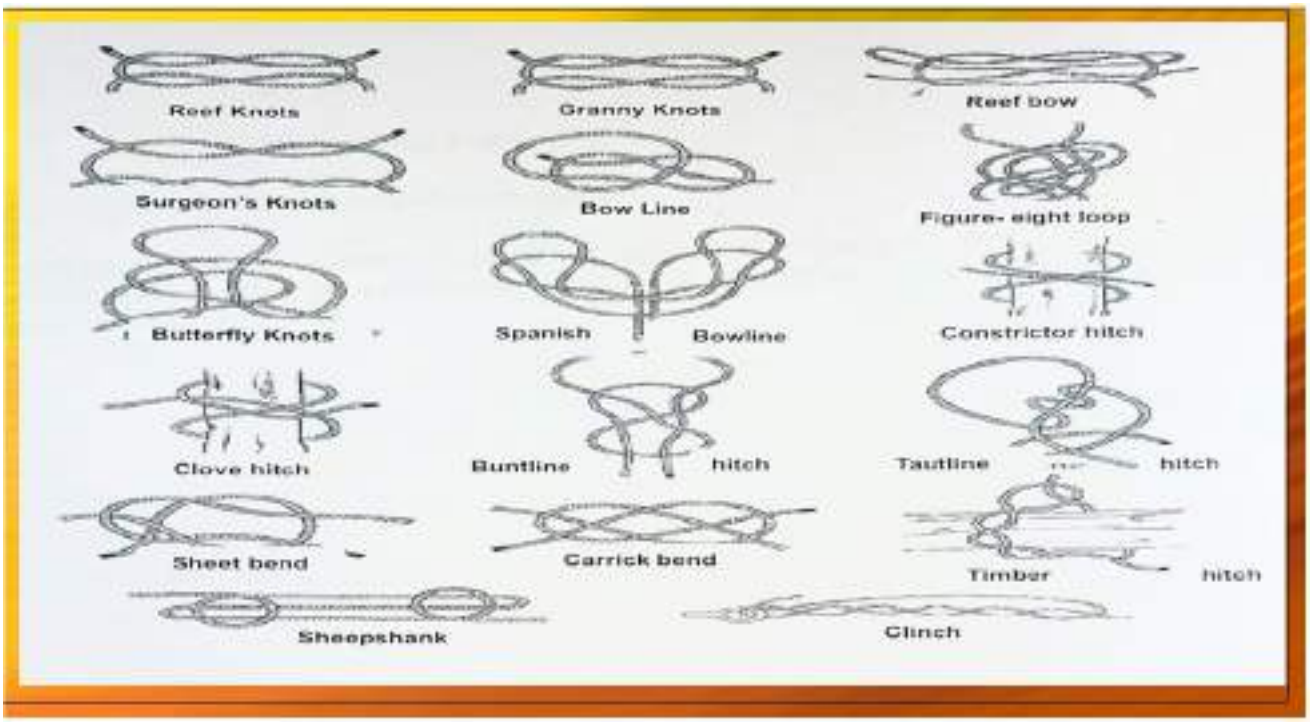
Q3. Elaborate various reasons for objects to be seen during day and night.

Q4. Differentiate between camouflage and Concealment.

Q5. How can drones be used to counter camouflage and concealment.

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-IV: KNOTS, LASHING AND STRETCHER



TEACHING INSTRUCTIONS

Period : 02 (80 Mins)
Type Year : 1ST Year (01) & 3rd Year (01) SD/SW
Conducting Officer : Permanent Instructor

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Preci Lesson plan, Board & markers and Open training area for practical classes/Practice.

Time Plan

- **Introduction : 02 Mins**
- **Part I : 15 Mins**
- **Part II : 20 Mins**
- **Part III : 40 Mins**
- **Conclusion : 03 Mins**

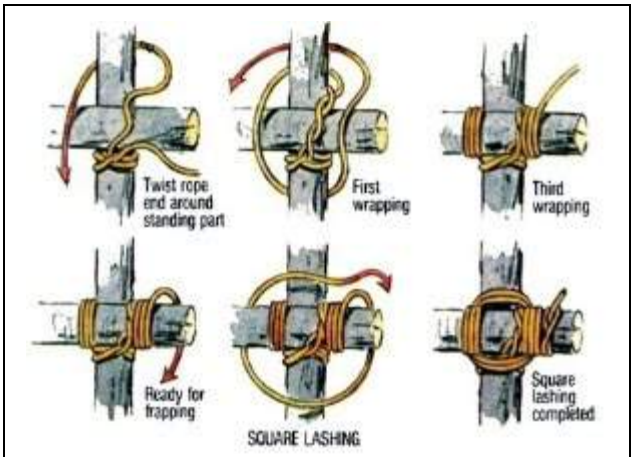
INTRODUCTION

1. The ability to join two pieces of natural material together and so increase their length, gives man the ability to make full use of many natural materials found locally. Knot tying is a useful exercise to obtain better coordination between eyes and fingers.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I: Types of Knots.**
- **Part II: Lashings.**
- **Part III: Stretchers.**
- **Part IV: Practical Training.**



INTERESTING FACTS

- **The standard size of a stretcher is L - 7’ 9” and W - 1’ 11” with length of canvas 6’**.
- **The types of Stretchers vary depending upon the nature of use and are different for hospital, ambulance and ship**.
- **Correct Lashing and Knots assist you in river crossing and obstacle crossing**.

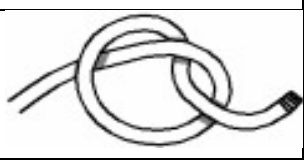
LEARNING OBJECTIVES

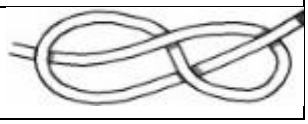
- **Make cadets understand the types & uses of various types of Knots.**
- **Basic understanding of Stretchers and their uses.**
- **Impart on ground training using natural resources.**

PART I: TYPES OF KNOTS

2. A brief description of the use to which the knot may be put is given in this lesson. The diagrams will explain how the knot is tied. The letter "F" means the free or untied end of the rope, and the letter "S" means the standing or secured end.

3. **Knots for Rope ends or for Grips on Thin Rope**.

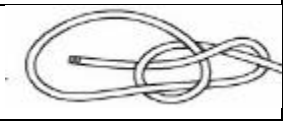
Ser No	Type of Knot	Sample
(a)	**Thumb Knot**. To make a stop on a rope end, to prevent the end from fraying or to stop the rope slipping through a sheave, etc.	

Ser No	Type of Knot	Sample
(b)	**Overhand Knot**. Over hand knot may be put to the same use as the thumb knot. It makes a better grip knot, and is easy to undo.	
(c)	**Figure Eight**. This knot is used as the thumb knot. It is easy to undo, and more ornamental.	

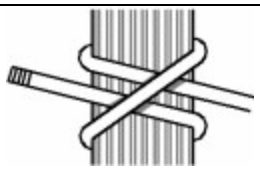
4. **Knots for Joining Ropes**.

Ser No	Type of Knot	Sample
(a)	**Reef Knot**. To securely join two ropes of equal thickness together. Notice the difference in position of the free and standing ends between this and the thief knot.	
(b)	**Thief Knot**. To tie two ropes of equal thickness together so that they will appear to be tied with a reef knot, and will be retied with a true reef knot. This knot was often used by sailors to tie their sea chests, hence the name.	
(c)	**Fisherman's Knot**. For joining two springy materials together; suitable for wire, fishing gut or vines. Two thumb knots (one on each rope) pulled tight. The knots lock together.	

5. **Knots to Make Loops in Rope**.

Ser No	Type of Knot	Sample
(a)	**Bowline**. To form a loop that will not slip on a rope end.	

6. **Knots for Fastening Ropes**.

Ser No	Type of Knot	Sample
(a)	**Clove Hitch**. For securing a rope to as par. This hitch, if pulled taut, will not slip up or down on a smooth surface. A useful start for lashings.	

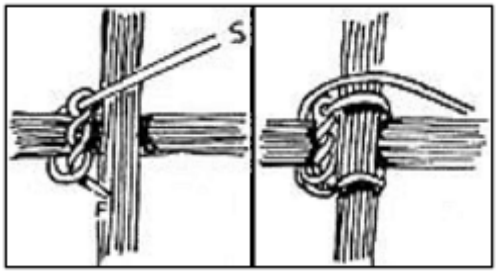
PART II: LASHINGS AND STRETCHERS

Lashings

7. The methods employed to tie with ropes, poles or any rope to a stationary object to securely hold it in place is known as lashing.

(a) **Square Lashing**. To join poles at right angles.

(b) **Frapping Turns**. These are turns that go round the lashing and pull it tight.



8. **Stretchers**. A stretcher, litter, or pram is an apparatus used for moving patients who require medical care. A basic type (cot or litter) must be carried by two or more people. A wheeled stretcher (known as a gurney, trolley, bed or cart) is often equipped with variable height frames, wheels, tracks, or skids.

9. **Basic stretchers**.

(a) Simple stretchers are the most rudimentary type. They are lightweight and portable, made of canvas or other synthetic material suspended between two poles or tubular frame. Many are stored as disaster supplies and are often former military equipment.

(b) The scoop stretcher is used for lifting patients, for instance from the ground on to an ambulance stretcher or on to a spinal board. The two ends of the stretcher can be detached from each other, splitting the stretcher into two longitudinal halves. To load a patient, one or both ends of the stretcher are detached, the halves placed under the patient from either side and fastened back together.

(c) The litter, also known as a rescue basket or Stokes basket, is designed to be used where there are obstacles to movement or other hazards; for example, in confined spaces, on slopes, or in wooded terrain. Typically, it is shaped to accommodate an adult in a face-up position and is used in search and rescue operations. The person is strapped into the basket, making safe evacuation possible. The litter has raised sides and often includes a removable head/torso cover for patient protection. After the person is secured in the litter, it may be wheeled, carried by hand, mounted on an ATV, towed behind skis, a snowmobile, or a horse, lifted or lowered on high-angle ropes, or hoisted by helicopter.

(d) A Reeves Sleeve, SKED, or "flexible stretcher" is a flexible stretcher that is often supported longitudinally by wooden or plastic planks. It is a kind of tarpaulin with handles. It is primarily used to move a patient through confined spaces, e.g., a narrow hallway, or to lift obese patients. Reeves stretchers have six handholds, allowing multiple rescuers to assist extrication.

(e) The Wauck board is also designed for use in small spaces. The patient is secured to the board with straps. It has two wheels and a foldable footrest at one end, allowing the patient to be moved by one person, much as with a hand truck for moving cargo. It can also be used at a variety of angles, making it easier to traverse obstacles, such as tight stairwells.

DID YOU KNOW?

- Stretchers can also be created using natural resources combined with your personal Kit.
- Stretchers can also be effective to control contagious diseases.
- Stretchers can also be prepared using your combat dress and ground sheet.

Stretcher prepared using combat dress

Stretcher prepared using Groundsheet

10. **Wheeled stretchers**. For ambulances, a collapsible wheeled stretcher, or gurney, is a type of stretcher on a variable-height wheeled frame. Normally, an integral lug on the stretcher locks into a sprung latch within the ambulance in order to prevent movement during transport, often referred to as antlers due to their shape. It is usually covered with a disposable sheet and cleaned after each patient in order to prevent the spread of infection. Its key value is to facilitate moving the patient and sheet on to a fixed bed or table on arrival at the emergency department. Both types may have straps to secure the patient.

PART III: PRACTICAL TRAINING

11. After theoretical class, the cadets will be given exposure of subject practically outdoor. Practical classes /Practice will emphasize on the following:-

(a) Making of various types of knots.

(b) Uses of various types of knots.

(c) Preparation & uses of various types stretchers - During the practice it will be ensured that natural resources are used to the optimum.

CONCLUSION

12. Knots, lashings and stretchers are very useful and become very handy for cadets during camps. They can make use of knots for joining or tying 2 to 3 different ropes together and make use of it during rope climbing, rappelling, slithering and other such adventure activities. Similarly, lashings can be used for joining 2 or 3 things together to make a structure that can useful in camps. For evacuation of any injured or causality stretchers are important to be known and used.

SUMMARY

- Various types of knots that can be life saving are:-
  - Thumb Knot
  - Overhand Knot
  - Figure Eight Knot
  - Reef Knot
  - Thief Knot
  - Fisherman’s Knot

- Bowline Knot
- Clove Hitch Knot

- Knots come handy while joining ropes and make loops.
- Various types of stretchers are:-
  - Basic stretcher.
    - Simple stretcher
    - Scoop stretcher
    - The litter (Rescue basket or Stokes basket)
    - Reeves Sleeve, SKED, or "flexible stretcher"
  - Wheeled stretcher
  - The Nimier stretcher

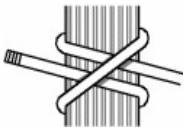
ASSESSMENT EXERCISE

Multiple Choice Questions & Fill in the Blanks

1. Identify the Knot/ Lashing

(a) Square Lashing (b) Thief Knot
(c) Fisherman's Knot (d) Overhand Knot

2. Identify the Knot/ Lashing

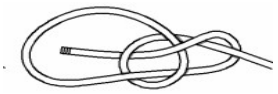


(a) Square Lashing (b) Thief Knot
(c) Fisherman's Knot (d) Clove Hitch

3. Clove Hitch is used for _____.

(a) Join ropes (b) Secure a rope to a Spar
(c) Make loops in rope (d) Make rope-ends

4. Identify the Knot/ Lashing



(a) Square Lashing (b) Thief Knot
(c) Bowline (d) Overhand Knot

5. Letter 'F' means _____end of the rope.

6. Letter 'S' means _____ end of the rope

7. Lashing is of _____ types

8. _____ Stretcher was used by the French Army during WW I.

9. Turns that go round the lashing and pull it tight is called

(a) Frapping Turns (b) Square Lashing
(c) Clove Hitch (d) Bowline

10. _____ is used for joining materials together to a springy fisherman's knot.

11. _____ is used to make a stop on a rope knot.

12. _____ is a type of rope that will not slip on a rope end.

Short Answer Questions

1. How many Types of knots are there? write names.

2. Give various types of Knots for joining ropes.

3. What are types of stretchers?

4. Differentiate thumb Knot & Overhand Knot with appropriate diagram.

5. What is Nimier Stretcher?

Long Answer Questions

1. Define Basic stretchers & Wheeled stretchers. Elucidate your answer with appropriate diagram.

2. Explain various types of Konts & their usages.

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-V: FIELD SIGNALS

“Do not repeat the tactics which have gained you one victory, but let your methods be regulated by the infinite variety of circumstances”

TEACHING INSTRUCTIONS

Period : 02 (80 Min)
Type Year : 2nd Year SD/SW
Conducting Officer : Permanent Instructor

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Precis Lesson plan, Board & Markers and Open training area for practical classes/.

Time Plan

- **Introduction : 03 Mins**
- **Part I : 05 Mins**
- **Part II : 05 Mins**
- **Part III : 05 Mins**
- **Part IV : 10 Mins**
- **Part V : 10 Mins**
- **Conclusion : 02 Mins**
- **Practical Training : 40 Mins**

INTRODUCTION

1. It is not always possible to give verbal orders through words of mouth because of battle noise, security reasons and intervening distance being too great for effective voice control. Whenever someone wants to convey his message, one has to raise his voice. In older days smoke, sound of drum was the mode to convey messages from one village to another. In Army, different methods are used to convey messages. Today, you will learn one of these methods called Field Signals.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I: Signals with Hand**
- **Part II: Signals with Weapons**
- **Part III: Signals with Whistle**
- **Part IV: Field Signals as Means of Giving Orders**
- **Part V: Signals by Day & Night**
- **Part VI: Practical Training**

INTERESTING FACTS

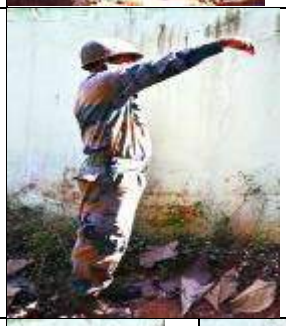
- **The standard size of a stretcher is L - 7' 9" and W - 1' 11" with length of canvas 6'.**
- **The types of Stretchers vary depending upon the nature of use and are different for hospital, ambulance and ship.**
- **Correct Lashing and Knots assist you in river crossing and obstacle crossing.**

LEARNING OBJECTIVES

- **Visual signals include flags, pyro techniques and ground to air signals.**
- **Soldiers can also use other items such as chemical light sticks and flashlights for to signals during inclement weather/ darkness.**
- **Each soldier must pass the signal to the soldier behind him to ensure acknowledgement.**

PART I: SIGNALS WITH HAND

Ser No	Name of Signal	Illustrations	Signal With Hand
(a)	Deploy	Right arm fully extended above head and waved from side to side, palm open.	
(b)	Advance	Right arm swung from rear to front in “under arm blowing” fashion.	 
(c)	Halt	Right arm raised to full extent above head.	
(d)	Turn About	Right arm raised and bent above head.	
(e)	Change Direction	Right arm raised to front in line with shoulder. Body then turned in required direction.	

(f)	Close	Right hand place on top of head, elbow to the right.	
(g)	Follow me	Right arm swung from rear to front above the shoulder in “over arm bowling” fashion.	
(h)	Enemy Approaching	Both hands open, palm in wards at waist level, with inwards scooping motion.	 
(j)	Enemy LMG firing	Right hand thumb down signal.	
(k)	Attack	Punching motion with Right or Left hand according to direction of attack.	 
(l)	Closed to Rendezvous	Close sign followed by both hands clasped in front of body at waist level.	 

(m)	Infantry obstacle ahead	Both hands crossed in front of body at the waist, palm open downwards.	

DID YOU KNOW?

- Field signals are alternative to voice control.
- Each soldier must pass the signal to the soldier behind him to ensure acknowledgement.

PART II: SIGNALS WITH WEAPONS

Ser No	Name of Signal	Signals with Weapons	Illustrations
(a)	Enemy in Sight	Rifle held above the head parallel to the small number muzzle in the direction of the enemy.	
(b)	Enemy in Sight in large number	As per (a) above, but arm moved up and several times.	 
(c)	Advance	Both arms raised to form the letter U	

PART III: SIGNALS WITH WHISTLE

Ser	Name of Signal	Signals With Whistle
(a)	Cautionary Blast	A short blast to draw attention to assign all or order about to be given.

Ser	Name of Signal	Signals With Whistle
(b)	The Alarm Blast	A succession of alternate long and short whistle blasts.
(c)	Enemy Aircraft	A succession of short blasts.
(d)	Enemy Aircraft departed	Two long blasts repeated at interval of five seconds.

PART IV: FIELD SIGNALS AS MEANS OF GIVING ORDERS

2. Field signals are alternate means of giving orders and to control troops when voice control is not possible. Control over troops deployed can be done better by field signals than by voice control. There are various occasions when voice control is not possible. They are:-

(a) **Battle Noises**. In war, due to firing and vehicle movement very high noise will be produced, so it may not be possible for a Commander to give voice message.

(b) **Need for Silence**. There are certain operations which, by design are carried out in utmost silence, e.g.:-

(i) Ambush.

(ii) Patrolling.

(iii) Raid.

(iv) Cordon.

(c) **Intervening Distances are Too Large**. When Infantry takes the battle field they come across many obstacles in ground such as the ditch, rivers, and mountains. Under such circumstances we will have the only choice left with us is field signals for communication.

3. **Methods to Attract Attention Of Troops**. Before any field signal is executed, the commander has to attract the attention of troops. Methods to attract attention of troops are:-

(a) A Short Blast of Whistle.

(b) A Bird Call.

(c) Whistle by Mouth.

(d) Clicks (By using tongue).

(e) Clicks by Fingers.

4. **Other Methods of Communication**. Besides field signals there are various other means of communication in the Army which are as follows:-

(a) Dispatch Runners.

(b) Dispatch Rider.

(c) Radio Sets.

PART V: FIELD SIGNALS DAY & NIGHT

5. **Field Signals By Day**. Some of the visual signals used during the day are flags and mercury coated mirrors. Flags are very effectively used by Navy on board a ship by following ways:-

(a) Flags: (Red, Green and White flags).

(b) Mercury coated mirrors.

(c) Smoke.

(d) Miscellaneous: Various signals can be improvised and pre-arranged as under:-

(i) Clothes superficially hung out to dry.

(ii) Hurricane lamp, kept in the window.

(iii) Flashing of torch is used as Morse Code.

(iv) Applying various cooler/ signs on forehead and arms.

6. **Field Signals by Night**. Some of the field signals that can be used at night are:-

(a) Pre decided signals on a walkie talkie.

(b) Click by fingers.

(c) Clicks by using tongue.

(d) Whistle by the mouth.

(e) Use of rope.

(f) Use of color light.

(g) Use of blacked out torch

(h) Firing of weapon

PART VI: PRACTICAL TRAINING

7. After theoretical class, the cadets will be given exposure of subject practically outdoor. Practice will include the following:-

(a) Field Signals with hand.

(b) Field Signals with weapons.

(c) Field Signals with whistle.

(d) Field Signals as means of giving orders.

(e) Field Signals during day & night.

CONCLUSION

8. The fighting efficiency of a unit/sub unit depends on sound communication system which helps commanders at all levels to exercise command and control effectively. Every commander must influence the battle by his personal touch which his achieved by good signal communications. Field signals become a part of movement of a good section/platoon commander. At section/platoon level, the commander directly influences the battle by the use of field signals. Victory in battle will come to that section/ platoon whose men are familiar in the use of field signals

SUMMARY

- When it is practically not possible to use verbal control orders, field signals are used to communicate with troops.
- Field signals can be given using hand, weapon or whistle.
- Various methods can also be improvised to communicate with troops during inclement weather as well as during works at darkness.

ASSESSMENT EXERCISE

Multiple Choice Questions and Fill in the Blanks

Q1. "Right Hand Thumb Down' is a Field Signal for _____.

(a) Enemy in Sight (b) Turn about
(c) Enemy LMG firing (d) Close

Q2. Field signals are alternate means of giving orders and to control troops when _____ control is not possible.

(a) Tactical (b) Voice
(c) Military (d) Line of Sight

Q3. "Right arm raised to full above head' is a Field Signal for _____.

(a) Advance (b) Attack
(c) Halt (d) Close

Q4. There are certain operations which, by design are carried out in utmost silence. Which are these?

(a) Ambush (b) Cardon
(c) Patrolling (d) All of these

Q5. Air photographs allow gradient to be seen in relief with the help of a _____.

(a) Binocular (b) Stereoscope
(c) Periscope (d) Stethoscope

Q6. _____ & _____ are the occasions when voice control is not possible.

Q7. _____ & _____ can be two improvised signals.

Q8. _____ & _____ can be two Field signals used at night.

Q9. Whistling in succession of short blasts is a signal for _____.

(a) Cautionary Blast (b) Alarm Blast
(c) Enemy Aircraft (d) Enemy Aircraft Depart

Q10. Rifle held above the head parallel to the small number muzzle in the direction of the enemy is signal for:-

(a) Enemy in sight
(b) Enemy in sight in large number
(c) Advance
(d) Deploy

Short Answer Questions

Q1. Explain Field signals both by Day & Night?

Q2. What are various methods of communication?

Q3. What are various methods to attract attention of Troops?

Q4. Explain two signals with whistle?

Q5. Explain Signal for Enemy in Sight?

Long Answer Questions

Q1. Analyze field signals as means of giving orders.

Q2. Explain various types of signals with hand.

Q3. Describe various signals with weapon & whistle.

Q4. Explains various signals with whistle?

Q5. Explain following signals?

(a) Deploy
(b) Enemy approaching
(c) Attack

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC-VI: FIRE AND MOVE CAPSULE

“If it is your advantage move forward, if not, stay where you are.”

TEACHING INSTRUCTIONS

Period : 03 (120 Min)
Type Year : 3rd Year SD/SW
Conducting Officer : Permanent Instructor

Training Aids: Class Room, Computer with OHP & Screen, Pointer Staff, Presentation, Precis Lesson plan, Board & Markers and Open training area for practical classes.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 10 Mins**
- **Part II : 10 Mins**
- **Part III : 10 Mins**
- **Part IV : 10 Mins**
- **Part V : 15 Mins**
- **Part VI : 10 Mins**
- **Part VII : 10 Mins**
- **Conclusion : 05 Mins**
- **Practical Training : 40 Mins**

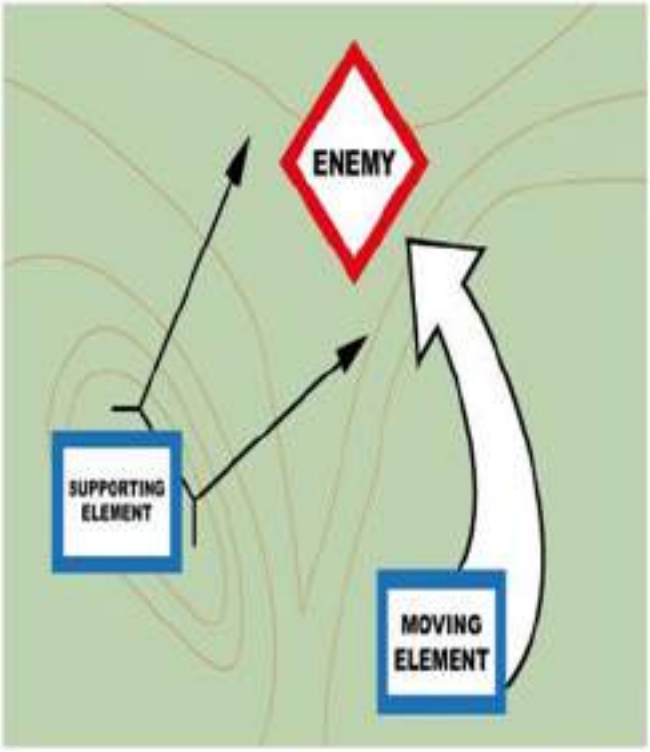
INTRODUCTION

1. The primary aim of infantry is to close in with the enemy & destroy him. The aim of getting close is achieved by making skillful use of ground. A clever enemy will however, deny to use of such ground which you may need. When such cover is denied by the enemy, we may have to move in open. Once we are forced to move in open, a part of our force will have to fire on enemy position & force him to keep his head down. This would render the enemy incapable of bringing down aimed fire at us while we are on the move. This process of keeping one element on the ground to give covering fire, while the other element is on move, is called Fire & Move. To understand the fire and move capsule cadets have to understand basic nuances.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I:Important Terms**
- **Part II: When to Use Fire and Move**
- **Part III: Basic Consideration of Fire & Move**
- **Part: IV-Use of Ground & Common Mistakes**
- **Part V: Selection of Fire Positions**
- **Part VI: Movement when under Fire**
- **Part VII: Crawls**
- **Part VIII: Practical Training**



INTERESTING FACTS

- **Fire orders are standardized verbal instructions given by a commander to control rate, direction and type of fire**.
- **Type of fire depends upon enemy's movement**.

LEARNING OBJECTIVES

- **Explain the requirement of fire & move**.
- **Basic understanding of various fire position & Equipment**.
- **Impart practical training based on classes conducted**.

PART I: IMPORTANT TERMS

2. Certain terms given below are commonly used in connection with fire control:-

(a) **Fire Unit**. Any number of men firing under the command of one man, usually, a section. The person responsible for giving the executive order of fire, is the fire unit commander.

(b) **Fire Direction Orders**. These are the orders which the fire unit commander receives from his superior, telling him when, at what target and with what intensity to open fire. A section commander will receive fire direction orders from his platoon commander. They include special directions about opening and withholding fire.

(c) **Fire Control Orders**. These are orders given by the fire unit commander to direct and control the fire of the section. Emphasis should be on control and supervision. These orders are the final with complete instructions after all factors have been considered and before fire is actually opened.

(d) **Arc of Fire**. This denotes the area of ground for which the fire unit is responsible and within which it will engage targets. An arc of fire, must not be confused with field of fire which is the area upon which it will be possible to fire effectively in any direction.

PART II: WHEN TO USE FIRE & MOVE TACTICS

3. Fire & Move tactics are used in following circumstances:-

(a) The enemy has opened SA fire which is effective.

(b) When own troops have seen the enemy first - within 400 to 700 meters.

(b) When the enemy is known or suspected to be in a certain area, then fire & movement tactics may be adopted when the troops reach within the effective range of enemy weapons/ observation. (Instructor to explain as to what could be the effective range of enemy's personal weapon).

(c) To cross obstacles by day or by night, e.g. nullahs /rivers.

PART III: BASIC CONSIDERATION OF FIRE AND MOVE

4. The primary aim of the infantry is to close with the enemy and destroy him. It is only possible to move forward against opposition by skillful use of ground, with the help of supporting fire or by a combination of both. The enemy will select positions which, as far as possible, give no ground cover to the attackers. By means of fire, mines and other obstacles he will attempt to halt the latter's advance. Supporting fire is, therefore, necessary to keep the enemy's head down and make movement possible. The combination of fire and movement is the basis of platoon and section tactics. It demands from the soldier the highest standards of weapon training and field craft.

5. Five basic considerations for fire and movement are as under:-

(a) There should be no exposed ground without covering fire.

(b) Control by the commander.

(c) The angle of covering fire from direct firing weapons should be as wide as possible without loss of control or time.

(d) **Miscellaneous**. Any identifiable visual or audio signal which is pre-arranged between the sender and receiver can be used as a signal. Some examples are:-

(i) Whistle.

(ii) Hurricane.

(iii) Flashing.

(iv) Replication of various types of natural saint like the sounds that the animals make.

(e) Sounds that the animals make.

Types of Control Orders

6. There are four types of control orders. These are explained below:-

(a) **Delayed Fire Order**

(i) "No. 1 Section –600-enemy approaching await my orders".

(ii) "No.1 Section 600-enemy advancing through jungle, fire when enemy reaches, open ground".

(b) **Opportunity Fire Order**. "No.1Section. Enemy hidden in broken ground, fire when seen".

(c) **LMG Group Fire Order**. "LMG group sight down–enemy running left or right– fire".

(d) **Full Fire Order**

(i) **Pin Point Target**. "No 2 Rifleman–300 Tree Right– 50 REDHUT-enemy sniper-fire".

(ii) **Area Target**. "LMG-Group-500-Tree-Right Grove, enemy section, burst fire".

Sequence of Fire Order

7. An accepted sequence should always be used in order to avoid confusion, or misunderstanding. The suggested code work is 'GRIT', each letter of which signifies stage in fire orders as follows:-

G - The Group of the section which is addressed, that is the LMG group or the whole section. An order starting with "No 1 Section" indicates that the whole of No.1 Section will fire. "LMG-Group or Rifles Group" means that the group named only will fire.

R - The Range to the target. To ensure accuracy of fire and to concentrate attention on a limited area of ground.

I - The Indication of the point of aim by its description.

T - The type of fire to be employed.

PART III: BASIC CONSIDERATION OF FIRE AND MOVE

8. The primary aim of the infantry is to close with the enemy and destroy him. It is only possible to move forward against opposition by skillful use of ground, with the help of supporting fire or by a combination of both. The enemy will select positions which, as far as possible, give no ground cover to the attackers. By means of fire, mines and other obstacles he will attempt to halt the latter's advance. Supporting fire is, therefore, necessary to keep the enemy's head down and make movement possible. The combination of fire and movement is the basis of platoon and section tactics. It demands from the soldier the highest standards of weapon training and field craft.

9. There are five basic considerations for fire and movement. These are as follows:-

(d) There should be no exposed ground without covering fire.

(e) Control by the commander.

(f) The angle of covering fire from direct firing weapons should be as wide as possible without loss of control or time.

(g) Full use should be made of all available cover. When cover is lacking the use of smoke (smoke grenade) should be considered.

(h) Full use should be made of all available weapons for covering fire.

PART IV: APPRECIATION OF GROUND & COVER AND TYPES OF COVER

Ground Appreciation

10. In a battle, fire and movement is applied according to the type of country over which it is fought. In open country the problem is how to find cover; in close country, there is the difficulty of finding positions with good observation and field of fire. In attack or defence, the skillful use of ground can help to gain in developing an eye for ground. Ground should be considered from the enemy's point of view. It should be appreciated under the following headings:-

(a) Fire positions.

(b) Observation positions.

(c) Cover from fire.

(d) Cover from view.

(e) Obstacles.

11. **Types of Cover**. Cover from view is often not cover from fire, especially if the move to cover has been seen by the enemy. Concealment from enemy air and ground observation is the chief means of gaining surprise. Some of the main types of cover are:-

(a) Undulating ground which is the least obvious form of cover; when skillfully used, it protects from direct fire and gives no ranging marks to the enemy.

(b) Sunken roads, beds of streams and ditches which give good cover from view and often from fire as well. However, there is always a danger that the enemy may pay special attention to them; they may be mined or booby-trapped and precautions against ambush must be taken. If the roads or ditches are straight, the enemy will be able to fire down them in enfilade.

(c) Hedges and bushes give cover from view but not from fire. In open country they may make good ranging marks for the enemy.

(d) Standing crops give cover from view but movement through them can generally be detected.

(e) Woods which give cover to men and vehicles from enemy air and ground observation. They give some protection from small arm fire but HE bombs and shells will explode in the branches of trees and will cause heavy casualties unless troops are dug in and have overhead protection.

(f) Buildings and walls afford concealment and protection from small arms fire and shell splinters. When isolated they make good ranging marks for the enemy.

PART V: USE OF GROUND FOR MOVE AND COMMON MISTAKES

12. **Dead Ground**. Ground which a soldier cannot see from his position is called dead ground. Platoon and section commanders should be able to recognize ground which is likely to be dead to the enemy. Ground can only be described as dead in relation to the position of an observer. Troops under cover or in dead ground are safe from enemy observed fire but not from in direct fire. These are as are always likely to be selected by the enemy as defensive fire tasks for his artillery and mortars. Dead ground is also safe from detection by battle field surveillance radars, as these have line of sight limitations.

13. **Common Mistakes**. The wrong use of ground may lead to casualties and loss of surprise; some common mistakes are:-

(a) Carelessness by troops while making a reconnaissance, such as unfolding a map in the open or not using a covered approach to an OP.

(b) Unnecessary movement in a position over looked by the enemy.

(c) Using conspicuous landmarks such as isolated trees, bushes or cottages.

(d) Halting troops near road or track junctions or other mapped features which are always registered as targets by the enemy.

(e) Bad track discipline.

(f) Failure to guard against enemy air observation.

Selection of Fire Positions

14. The ideal fire position should be:-

(a) Provide cover from fire.

(b) Provide cover from view.

(c) Afford a good view of the ground to be watched or target to be engaged.

(d) Provide room in which to use the weapon freely.

(e) Have a covered approach.

(f) Be easy to advance from.

15. The selection of fire positions requires a knowledge both of the characteristics of weapons and of the use of ground. A direct firing weapon must be sited with an eye at the level from which it is to fire. A target which is clear to a man standing may be invisible to one lying down.

16. Sometimes it may be necessary to site fire positions on trees, roof tops, or walls to produce fire effect. This may result in plunging fire, but this must be overcome by accurate shooting. Cunning concealed fire positions will puzzle the enemy, protect the troops from observed fire and safeguard them against air attack.

Fire Control in Attack and Defence

17. There is a big distinction between fire control in attack and in defence. In attack men should be allowed a great deal of latitude in opening fire. Speed and immediate fire effect is what is required. With a well concealed enemy it will often be necessary to “neutralize” an area by fire since few definite targets will be visible. In defence, the vital factor in fire control is that early opening of fire may give away positions to the enemy and jeopardize concealment. Normally, a section commander will lay down a line in front of his section post beyond which fire will not be opened without his orders. This is particularly important where a long field of fire is available. In any case fire will normally be opened on the orders of the section commander.

PART VI: MOVEMENT WHEN UNDER FIRE

18. Movement in the face of the enemy should be covered by fire. This does not mean that it is impossible to move unless a heavy weight of fire is brought down on the enemy. An important part of an attack is the movement towards the objective, supporting fire is one of the aids to that movement. A knowledge of how to move and how to use ground for movement is essential to enable troops to close with the enemy with minimum casualties, undetected in the zone of arc of battle field surveillance radars.

19. Usually, troops advancing by day in action will move at a brisk walking pace until they make contact; in the final stages of the assault, they will double. They may have to double or crawl at other times; for example, if attacking troops move into enemy defensive fire, it is usually best to double forward and through it; to lie down is often dangerous as well as useless. Doubling and crawling are both tiring however, and should only be used in short spells in critical situations particularly for crossing open ground in full view of the enemy. The

commander must himself decide on his pace from his personal knowledge of the state of fitness of his men. In general, the aim must always be to keep moving determinedly towards the enemy at the best possible speed.

20. When crossing an open space like a gap in a hedge, it is best for the whole section or group to double across it together, before the enemy has time to fire effectively. When wider gaps are under enemy observation, it may be necessary to filter men across now and again by crawling in ones and twos.

PART VII: CRAWLS

21. A knowledge of how to move correctly and how to use ground is important to enable individuals and groups of individuals to close with the enemy, while exposing themselves as little as possible to enemy's view and fire. A knowledge to move correctly using correct cover as per the ground is essential. This is also essential for snipers and the patrols to accomplish their tasks. Every feature, natural and artificial, must be used to provide cover from the fire and view.

22. The method of movement is given below:-

(a) **Crawling by Day without Rifle**.

(i) Monkey Run.
(ii) Leopard Crawl.
(iii) Roll.

(b) **Crawling by Day with Rifle**.

(i) Leopard Crawl.
(ii) Side Crawl.

(c) **Crawling by Night**.

(i) The Ghost Walk.
(ii) The Cat Walk.

CRAWLING BY DAY

23. **Monkey Run**. There is useful for moving behind low cover up to about two feet high. Go fast for about 15 meters, drop flat, pause and then crawl further. The method of crawling is explained below:-

(a) **Without Arms**. This is done on hands and knees. Hands are moved forward in turn and so are the knees. Every time a hand is moved forward, the knee corresponding to it is also moved forward to the spot vacated by the hand. When silence is more important than speed. The knee should be placed on the exact spot vacated by the hand. When silence is more important than speed, the knee should be placed on the exact spot vacated by the corresponding hands. The hand should reach forward to safe place.

(b) **With Rifle**. The rifle may be held in the Right hand at the point of balance. Care must be taken to keep the muzzle up to prevent dirt from getting in.

24. **Leopard or Stomach Crawl**. This is useful for moving behind low cover. The method of crawling is explained below:-

(a) **Without Arms**. This is done on elbows and knees. Hug the ground with chest and crouch flat on the ground and arms, outstretched in front. Propulsion is obtained from alternate elbows and knees movement. While crawling roll slightly from side to side as each knee is bent. Avoid kicking up the heels and keep the head, body and elbows close to the ground. Alternatively, one knee only can be used the other led trailing along the ground.

(b) **With Rifle**. This is done on knees and elbows by moving the rifle forward holding the RIGHT hand under the rifle between the points of balance and the outer hand. An alternative method is to grip the rifle diagonally across the body with small of the butt underneath the RIGHT armpit.

25. **Walk**

(a) Never walk with the head bent as this affords no protection but hinders observation. Walk with head up and observe all the while. Silence is important when crossing hard ground, the least noise is made if the outside of the sole of the boot is placed first on the ground. Balance is essential to silent movement and this is assisted by keeping the knees slightly bent.

(b) **With Rifle**. Rifle is held in the LEFT hand across the body, ready for instant action. Carry the rifle so that it looks as a part of you. The alternative method is to carry rifle near the front swivel and the RIGHT hand holding the small of the butt.

26. **Roll**

(a) Roll away keeping the arms to the sides or stretched forward. This is often the quickest way of getting away from a spot where the enemy has seen you. Practice is necessary if the tendency to giddiness is to be overcome.

(b) **With Rifle**. When rolling to the right keep the rifle into the RIGHT side and vice versa.

Crawling with LMG

27. **Knee Crawl (No 1)**

(a) This is useful for moving behind waist height cover e.g. wall, hedgerows.

(b) This one is with the LMG only. The LMG is held in the left HAND. LEFT foot, Right knee and Right hand are placed on the ground. The bodyweight is taken on the RIGHT knee. The Right and the Left foot are moved forward simultaneously followed by the RIGHT knee.

28. **Side Crawl (No 1)**. Lie on a side and rest the gun on the instep of lower leg which is kept flat to the ground. Hold the carrying handle with the Right hand and the barrel with the LEFT. Propulsion is obtained by kicking with upper leg.

29. **Leopard Crawl (No 1)**. Take the gun forward to the limit of the extent of the arms and propel the body forward by legs using the leopard crawl method.

DID YOU KNOW?
➢ A very effective method in open ground is “Crack and Thump”.
➢ Situation awareness is a MUST.

30. **Combined Leopard Crawl (Nos 1 & 2)**. No1 grip the small of the butt in her left hand, No 2 grips the bipod legs in her Right hand. They both move forward using the leopard crawl. No 1’s LEFT arm` and leg keep step with No. 2’s RIGHT arm and leg and vice versa.

THE LEOPARD CRAWL (A)

THE LEOPARD CRAWL (B)

31. **Combined Leopard Crawl by Bounds (Nos 1 & 2)**. Nos 1&2 crawl forward 2 to 3 meters, and lift the gun forward. In this method the gun is kept continuously in the firing position.

CRAWLING BY NIGHT

32. **Ghost Walk**. For all night movements silence is more important than speed. Silence can only be achieved by perfect balance. Stand up, lift the legs high to avoid long grass and sweep them outwards in a semicircular motion. Feel gently with the toes for a foot hold. Makes sure that one foot is safe before the next foot moves, and knees lightly bent. Always lie down when you halt at night.

33. **Cat Walk**. Get down on the hands and knee and move each hand forward searching the ground carefully, making sure there are no twigs, then raise the knee and put it down on the spot where the hand is. Then move the hand forward again. This is very slow method but very sure.

34. **Kitten Crawl**. If the ground is covered with twigs the normal stomach crawl make noise. When moving very close to the enemy and when perfect silence is essential the only sure method is to keep raising the whole body off the ground on the fore arms and the toes

pressing forwards lowering the body, feeling carefully with hands each time. This is very slow and tiring method which requires considerable practice, but is invaluable. Accurate information at night can often only be obtained by movement very close to the enemy.

35. **Stalk**. Ground however carefully selected together with camouflage alone is not sufficient to enable us approach the enemy. One must use it like an animal staking its prey instinctively and unerringly. The use of ground and camouflage combined with the actual move forms the basis of all minor tactics.

PART VIII: PRACTICAL TRAINING

36. After theoretical class, the cadets will be given exposure of subject practically outdoor. This will include the following:-

(a) How to give various fire control orders.

(b) Selection of on ground positions.

(c) How to do movements in face of the enemy.

(d) Various types of crawls with and without weapon.

CONCLUSION

37. Fire & Move is the basic skill of tactics. Its training provided to all the officers and Jawans. The basic aim is to enable one detachment of soldiers to move while the enemy is pinned down by the effective fore of the other temporarily static body soldiers. It is the most effective and safest method to move during operations or when in contact with the enemy.

SUMMARY

- Various circumstances under which fire & movement tactics may be used are when enemy has opened effective fire, when troops have seen within 400-700 meters or to cross obstacles by day & night.
- Selection of fire position & sticking to fire control is of paramount importance during any operations.
- The sequence of fire Control Order is GRIT.

ASSESSMENT EXERCISE

Multiple Choice Questions & Fill in the Blanks

Q1. In Fire and Move tactics, the angle of _____ should be as wide as possible without loss of control or time.

(a) Direct Fire (b) Indirect Fire
(c) Enemy Fire (d) Covering Fire

Q2. Orders given when there is no time to give out a Full fire order, are called _____ Fire Control Orders.

(a) Delayed (b) Opportunity
(c) Brief (d) Full

Q3. Orders given by the fire unit commander to direct and control the fire of his fire unit are called _____.

(i) Fire Direction Order (ii) Fire Control Order
(iii) Attack Order (iv) Firing Orders

Q4. The area of ground for which the fire unit is responsible and within which it will engage targets is called_____.

(a) Arc of Fire (b) Firing Range
(c) Field of Fire (d) Firing Area

Q5. Orders given when there is notmoving continuously seen by everyone in the section, are called _____ Fire Control Orders.

(a) Opportunity (b) Delayed
(c) Brief (d) Full

Q6. GRIT stands for _____, _____, _____ & _____.

Q7. The area of ground for which a fire unit is responsible is called _____.

Q8. The Orders that the fire unit commander receives from his superior is called _____.

Q9. The basic principle of fire & move is _____.

Q10. Getting down on hands & knees, and moving each hand forward searching the ground carefully is called _____.

(a) Kitten Crawl
(b) Cat Walk
(c) Leopard Crawl
(d) Ghost Walk

Q11. The quickest way of getting away from a spot where the enemy has seen you is called

(a) Knee Crawl (b) Side Crawl
(b) Kitten Crawl (d) Roll

Q12. Orders given by Fire Unit Commander to direct and control the fire of the Section is called _____.

Short Answer Questions

Q1. Write five basic considerations for fire and movement.

Q2. Write Ideal fire positions.

Q3. What are the factors for selecting a fire position?

Q4. What do you understand by fire direction order?

Long Answer Questions

Q1. Explain all types of Crawling.

Q2. Describe Types of Cover.

Q3. Elaborate sequence of fire control order.

Q4. What are the points for section Commander and what are the methods of giving the orders.

FIELD CRAFT AND BATTLE CRAFT (SD/SW)

CHAPTER FCBC VII: SECTION FORMATIONS (FCBC-VII)

"Let your rapidity be that of the wind your compactness that of the forest."

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Min)**
Type Year	**:**	**3rd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, A Computer with OHP & Screen, Pointer Staff, Presentation, Preci Outdoor Trg in Trg Area, board & markers and Open training area for practical classes.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 05 Mins**
- **Part II : 05 Mins**
- **Part III : 05 Mins**
- **Part IV : 05 Mins**
- **Part V : 05 Mins**
- **Conclusion : 10 Mins**

INTRODUCTION

1. Various formations are used when troops come in contact with the enemy and the type of formation adopted is entirely dependent on the following four basic factors:-

(a) Degree of control required to be exercised by the Section Commander.

(b) Type of ground.

(c) Necessity of bringing down maximum fire with minimum delay.

(d) Task.

PREVIEW

The lecture will be conducted in following Parts:-

- **Part I: Types of formations**.
- **Part II: Section Battle Drill**.
- **Part III: Scout**.
- **Part IV: Types of Patrols**.
- **Part V: Practical Training**.

INTERESTING FACTS

- **Patrolling without being detected is of paramount importance**.
- **Section Formation vary based on the nature of ground and weather conditions**.
- **Patrolling during day and night have significant differences**.

LEARNING OBJECTIVES

- **Explain Various Types of Formations by a Section**.
- **Role, meaning and tasks of scouts**.
- **Explain about various types of Patrols**.

PART I: TYPES OF SECTION FORMATIONS (EXPLANATION WITH DIAGRAM)

2. A Section is the smallest sub unit of an Infantry Battalion and is capable of undertaking independent task. It consists of ten persons who are organized in Rifle group and Support Group. Different types of formations adopted by a section are as under with its advantage & disadvantages:-

SINGLE FILE FORMATION

(a) Single file formation is a formation that is useful for control, moving along narrow paths, and following linear features.

(b) In this formation, each person follows the person in front of them.

ADVANTAGE	DISADVANTAGE
Good for control, not vulnerable to enfilade fire, useful for moving along ditches, narrow defiles and so on.	Bad for fire production, vulnerable to frontal fire.

FILE FORMATION

(a) File formation is a formation where troops are lined up in a column, one behind the other. The width of a column of troops is measured by the number of files.

(b) File formations are useful when troops are unsure of the enemy's position because the overlapping fields of fire from each soldier provides protection from a potential flanking attack.

ADVANTAGE	DISADVANTAGE
Good for control. Useful for moving along broad roads, wide nullahs and so on.	Not good for fire production, vulnerable to frontal fire.

ARROW HEAD FORMATION

An arrowhead formation is a tactical formation used to move across open ground while providing security to the front and rear. It is also known as a "**V**" shape formation.

ADVANTAGE	DISADVANTAGE
Good depth, not vulnerable to frontal fire, good for fire production, probably the best formation for crossing open ground.	Control more difficult than in diamond.

SPEAR HEAD FORMATION

A spearhead formation is a formation where soldiers are organized to maximize their offensive and defensive capabilities.

ADVANTAGE	DISADVANTAGE
Good depth, less vulnerable to enfilade fire than arrow head, LMG group not committed immediately on contact.	Control difficult. Delay in fire production.

DIAMOND FORMATION

The diamond formation is a military formation used in warfare, especially by cavalry, throughout history. It's used when crossing open country at night and is easy to control, while providing good protection and observation.

ADVANTAGE	DISADVANTAGE
Good for control, not vulnerable to enfilade fire, good for all round fire production and observation.	Present a good target to frontal fire. Not very good for fire production to the front.

EXTENDED LINE FORMATION

An Extended line formation is a battle formation where soldiers are positioned in ranks, with each rank about half a meter apart and soldiers in each rank close together a line formation is a battle formation where soldiers are positioned in ranks, with each rank about half a meter apart and soldiers in each rank close together.

ADVANTAGE	DISADVANTAGE
The formation used in the final assault. Very good for fire production (from the hip) and bayonet fighting.	Control difficult. Very vulnerable to enfilade fire, no depth.

PART II: SECTION BATTLE DRILL

3. The Section Commander, as he advances, will constantly be on the lookout for:-

(a) New reference point for fire control orders. He may describe these to the section as they advance and each may acknowledge with a signal or shout ‘Not seen’ if he had failed to recognize the reference points and position where the section can take cover in the event of coming under effective fire. Whenever, possible the section commander will indicate such positions in form of anticipatory orders e.g. ‘if we come under effective fire, LMG group takes cover in those bushes, rifle group along that bank’.

4. It is instinctive to most men to drop down on the ground, when under fire. The men should not go to ground till the effective fire of the enemy is brought down or the order ‘Take Cover’ is given by the Section Commander. On receiving order for taking cover the following action will normally be taken by each man of the section:-

(a) Run to the nearest cover or that already indicated by the Section Commander in his anticipatory orders.

(b) Everyman will dive or drop into the cover and crawl away so that the enemy has not got his sights on any one when here-appears.

(c) Take position and observe the enemy.

(d) Apply sight and fire on spotting the enemy without waiting for an order from the section commander.

(e) Bunching together should be avoided at times and apart from No 1 and 2 of the LMG group, when necessary, no man in the open by day should ever be less than 5 meters from his nearest fellow, depending on the cover available.

(f) On ‘TAKE COVER’ order by the section commander, DASH-DOWN-CRAWL-OBSERVE-SIGHTS-FIRE (If the enemy has been located).

PART III: SCOUT

5. Now you have seen section formation, a word about the scouts. Scouts are the eyes and ears of the section. Scouts always work in pairs. They work ahead of the leading section and advance from bound to bound. As scouts, one must always be alert.

6. You have so far learnt the organization of a section and the various formations adopted by a section in battle. Remember, a section is organized in to the Rifle Group and Fire Support Group to facilitate fire and move, the basic of all tactics. As for the section formations, each formation has its peculiar advantages and disadvantages. Remember, need for command and control and the necessity of developing the maximum fire quickly, will determine the formation you as a section commander must adopt.

PART IV: TYPES OF PATROLS

7. There are two types of patrols:-

(a) Reconnaissance Patrols (Recce Patrols).

(b) Protective Patrols.

Recce Patrols.

8. The aim is to gain information secretly and silently without getting involved in fight. It may however have to fight some times for information which should be conveyed to proper commander in time to be of value.

Composition.

9. The party should be small. It should consist of a patrol leader usually an officer or a JCO and his escort of one or two men. Where it is evident that information cannot be obtained unless the patrol is prepared to fight, its strength must be adjusted in accordance with the requirements.

Arms.

10. It is ideal to carry only close quarter battle weapons. Heavier weapons should be avoided.

Protective Patrols

Duties.

11. Patrols engaged in protective duties will have to patrol on the front allotted to them. Their tasks will include denying approaches to enemy patrols and obtaining earliest possible information of the approach of the enemy.

Strength and composition

12. Patrols engaged in protective duties should be prepared to fight and should be organized accordingly. The strength will depend on the task. This must be supported by a carefully worked out fire plan if required.

Technical Representatives

13. Patrols whose tasks are solely of obtaining information of technical nature will include representatives of technical arms. The commanders of such patrols are infantry officers, irrespective of the rank of the specialist representatives included in the patrol.

PART V: PRACTICAL TRAINING

14. After theoretical class, the cadets will be given exposure of subject practically outdoor. This will include the following:-

(a) Various types of formations as per group.

(b) Battle Drill & Battle Cry.

(c) Types of patrols.

CONCLUSION

15. In each of the section formations, the positioning of the LMG and rifle groups is the responsibility of the section commander. He may order a gap to be left between groups and may even split his rifle group into parts as is frequently done in jungle fighting. His own position in the section should ensure good command and control. The training and efficiency of a section is judged from the work of the scouts. Patrols speed and safety depend upon them. They should work in pairs making intelligent use of the ground. The success of any patrol depends upon careful preparation, good leadership, and determination of all members of the patrol, good warning and high morale.

SUMMARY

- Successful use of section formations relies on teamwork and trust between soldiers. The unit's ability to operate as a cohesive entity directly impacts mission success.
- It is important for the section leader to assess the environment and adjust accordingly.
- The section leader plays a pivotal role in guiding the team, ensuring communication, maintaining discipline, and directing the unit's actions in the battlefield.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. A section consist of _____persons who are organised in to a Rifle Group and a Support Group.

(a) 36 (b) 50
(c) 10 (d) 16

Q2. Which of the following section formations should be avoided while moving in open terrain/ plain land?

(a) Single File Formation (b) Arrow Head Formation
(c) Diamond Formation (d) Spear Head Formation

Q3. On a narrow mountain track leading up to a hill top, which section formation would you suggest to be the best to adopt?

(a) Arrow Head Formation (c) Single File Formation
(b) File Formation (d) Extended Line Formation

Q4. While going in for the final assault on an enemy position, which section formation would you suggest to be the best to adopt?

(a) File Formation (b) Single File Formation
(c) Arrow Head Formation (d) Extended Line Formation

Q5. Patrols detailed to gain information of enemy is called _____.

Q6. _____&_____ are the two types of patrols?

Q7. _____ formation is formation that is useful for control moving along narrow paths and fallowing linear feature?

(a) File (b) Single
(c) Arrow Head (d) diamond

Q8. _____ Formation is useful for moving along broad roads & wide nullahs?

(a) Arrow Head (b) Diamond
(c) Spear Head (d) File

Q9. _____ formation is used for final assault?

(a) Extended line (b) File
(b) Diamond (d) Spear Head

Q10. On orders of “TAKE COVER” by Section Commander, the section will:-

(a) Dash-Down-Crawl (b) Change Towards Enemy
(b) Stand of fire (d) Bunch together

Q11. There are _____ type of Patrol?

(a) One (b) Two
(c) Three (d) Four

Q12. Patrols carry _____ type of Weapons:-

(a) Rocket Launcher (b) LMG
(c) MMG (d) Close Quarter Battle Weapons

Q13. The aim of Recce Patrol is:-

(a) Engage the Enemy (b) Ambush Enemy Patrol
(b) Gain information secretly and silently (d) Deny approach to Enemy Patrol

Q14. Patrols which cover meant to chevy approach to enemy are called:-

(a) Scout (b) Protective Patrol
(c) Recca Patrol (d) LMG group

Q15. The Partitioning of the LMG and rifle groups is the responsibility by:-

(a) LMG 1 (b) Section Commander
(c) LMG – 2 (d) Section Second in Command

Short Answer Types Questions

Q1. How many types of Patrols are there? Explain briefly.

Q2. Describe Section Battle Drill.

Long Answer Types Questions

Q1. Define all types of section formations with digrams.

Q2. What are types of patrols and how do they differ from each other?

MILITARY COMMUNICATION

3

CHAPTER WISE INDEX: MILITARY COMMUNICATION

MILITARY COMMUNICATION (SD/SW)

CHAPTER MC I: TYPES OF COMMUNICATION

"The telephone gives us the happiness of being together yet safely apart (Mason Cooley)"

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, Computer with OHP, Screen, Pointer Staff, Presentation, Script/Book/Lesson Plan, Board, and Markers

Time Plan

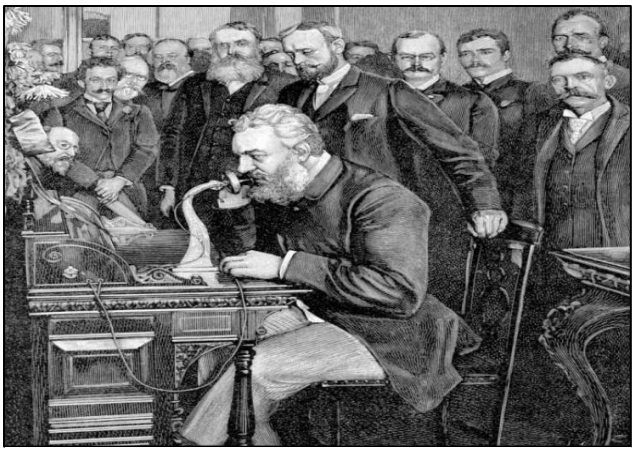
- **Introduction : 02 Mins**
- **Part I : 08 Mins**
- **Part II : 18 Mins**
- **Part II : 10 Mins**
- **Practice : 30 Mins**
- **Conclusion and Summary : 02 Mins**

INTRODUCTION

1. Communication is the process where a sender shares a message with a receiver. First, the sender thinks of a message and decides how to express it (this is called encoding). Then, the message travels through a medium, like speaking, writing, or using technology. The receiver gets the message, interprets it (decoding), and gives feedback, like asking a question or responding. However, there are barriers that can make communication difficult, such as noise, language differences, emotions, or misunderstandings, which can interfere at any point in the process and affect how well the message is understood.

Flow Chart of Communication

2. Up till 1870's the people as well as the militaries of the world used dispatch riders, pigeons, light signals like light house and sound signals like drums to communicate over large distances. The invention of the telephone in 1876 by Graham Bell revolutionized the world of communications as individuals could speak directly to each other over large distances instantaneously. This brought in the era of line communication and morse code in the militaries. Subsequently, with the introduction of wave-based communications Radio sets were introduced in the Armies which remained the main stay of military communication until recently wherein digitization, internet and satellite-based communication have revolutionized the way people communicate both in the civil as well as in military domains.



First Communication on Telephone

Army Solider communicating on Radio set

3. The Military Communications refers to all aspects of communication or transaction of information by the Armed Forces including line, radio and digital media in battle and non-battle conditions. It includes the infrastructure, equipment, and protocols used by the military to facilitate communication between different sub units, units and command levels during operations or during peace. The primary purpose of any good military communication system is to ensure secure, reliable, and efficient communication across various domains, enabling coordination, command, and control. In this chapter the cadets will learn about the basics of military communications including line and radio communication.

INTERESTING FACTS

- **Indian Army Corps of Signals is the primary agency of Indian Army, which handles its military communications. It was formed on 15 February 1911 as a separate entity under Lieutenant Colonel S H Powell.**

PREVIEW

The lecture will be conducted in the following parts:

- **Part I: Line Communication.**
- **Part II: Radio Communication.**
- **Part III: Types of Radio Communication.**

LEARNING OBJECTIVES

- **Line communication - Basic components and advantages and disadvantages.**
- **Radio communication - Constituents, types of waves and propagation of waves.**
- **Advantages & disadvantages of net radio communication**
- **Advantages & disadvantages of radio relay communication.**

4. Some communication systems and equipment designed for use by defence forces are as under:

(a) High-frequency and very high frequency fixed and mobile radio communications.

(b) Ultra-high frequency combat net radios and accessories.

(c) Satellite based communication and navigation systems.

(d) Military neck microphones, handsets, headsets, and speakers.

(e) Military broadband or military intranet-based communication systems.

(f) Various types and format of secure line based, point to point communication systems.

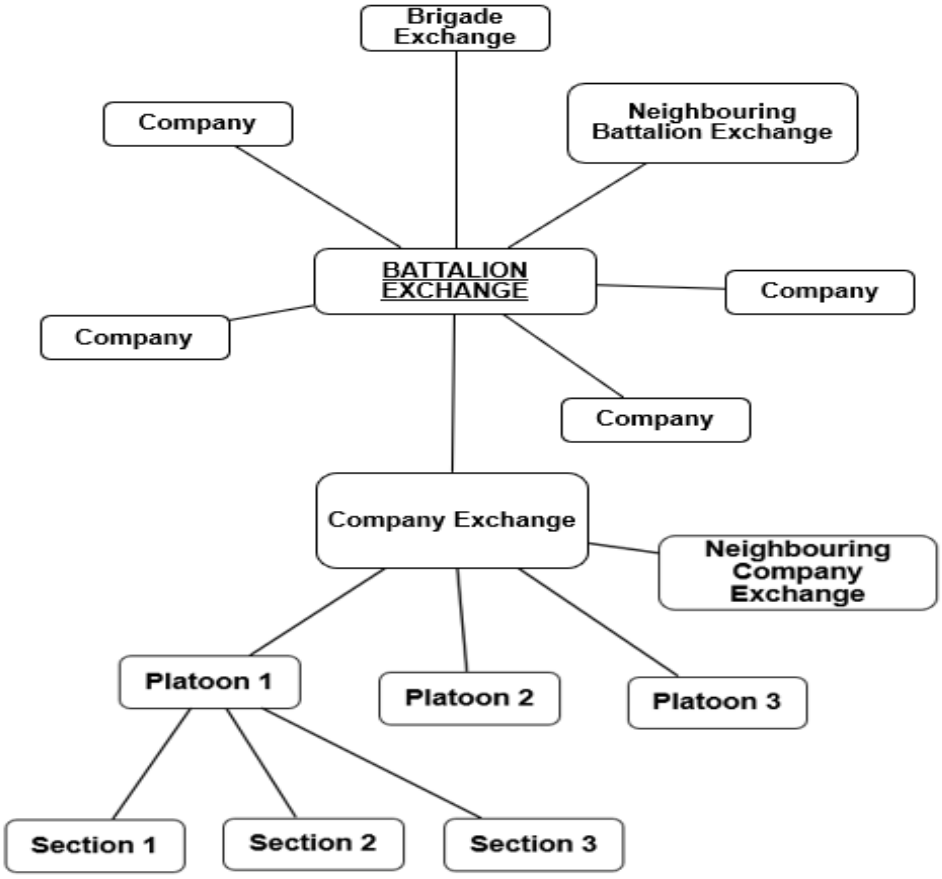
PART I: LINE COMMUNICATION

4. Line-based communication refers to the transfer of information between two or more people using a physical medium, like wires or cables. This type of communication relies on a direct, fixed connection, such as telephone lines or internet cables, to send messages, data, or signals. It is often used in systems like landline phones or broadband internet, where the message travels along a specific path between the sender and receiver. A telephone is best and most secure means of signal communication between individuals. A modern-day line communication set up requires exchanges, trunk media connecting exchanges, and local loop/cable to extend telephone connections to subscribers. A standard line communication set up in battle condition in any army unit will have about 30-40 telephone sets which are connected with an exchange and the range of communication is about 8 to 10 Kms. The telephone cables are laid on the ground connecting all subscribers to an exchange. Similarly, two exchanges can also be connected with line to enhance the subscriber base and range. Primarily, this is the basic means of signal communications for a static forces or when the forces are not moving.

Components of Line Communication

5. **Components of Line Communication**. These are sender, receiver, communication medium, the message to be communicated, and certain rules called protocols to be followed during communication. The components of line communication are as under:-

LAYOUT OF A BASIC LINE COMMUNICATION NETWORK



6. **Components of a Magneto Telephone set**. There are many types of simple magneto telephones, which are used by Indian Army for setting up line communication. The ringer arm of the magneto telephone is rotated to generate a ring at the exchange. Thereafter communication is made through the exchange with the required subscriber. To communicate pressel switch of the handset is pressed before speaking. The main components of a simple magneto telephone are as under:-

(a) Leather case with carrying strap.

(b) Generator handle.

(c) L1 and L2 Terminals.

(d) Handset.

(e) Microphone and Receiver.

(f) Pressel switch.

(g) Cord.

(h) Terminals for hand set.

(j) Socket for Hand set.

(k) Cable switch for CB Exchange.

(l) Battery Compartment.

Advantages and Disadvantages of Line Communication

7. **Advantages**.

(a) Reliable and practically free from electrical interference.

(b) Relatively secure.

(c) The number of circuits and message-carrying capacity is more but limited only by the availability of material and manpower.

8. **Disadvantages**.

(a) Vulnerable to physical interference and enemy interception along the entire length of the route.

(b) Takes time to construct.

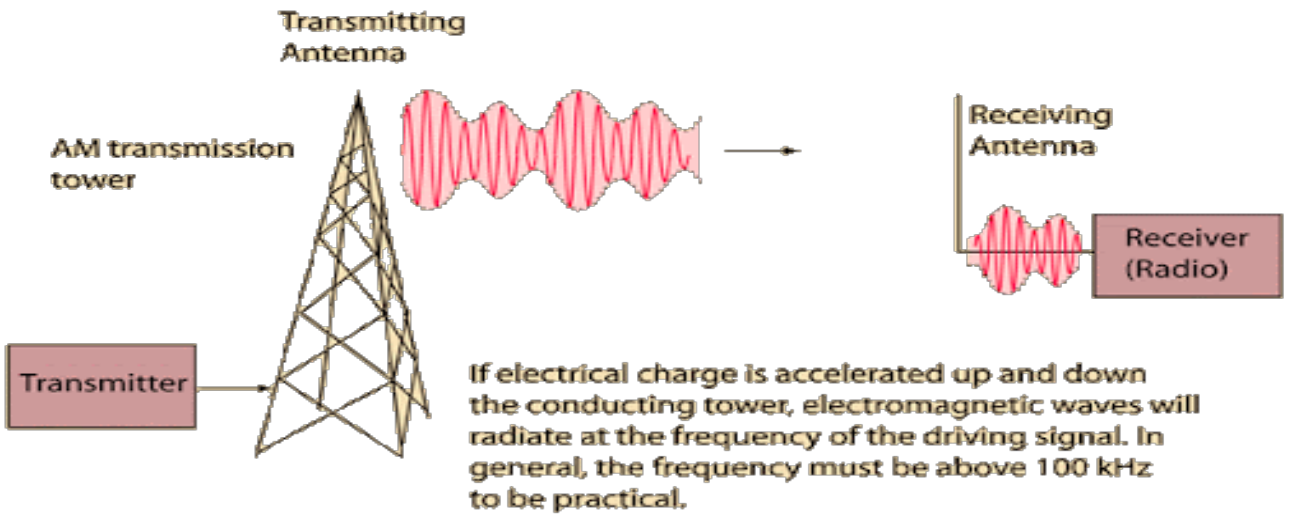
(c) Inflexible once it is laid.

(d) Expensive in men and material.

PART II: RADIO COMMUNICATION

9. **Components of Radio Communication**. Radio is the technology of using radio waves to carry information such as sound, by systematically modulating properties of electromagnetic energy waves. The information in the waves can be extracted when radio waves strike an electrical conductor and transform it back into its original form. Radio communication requires the use of both transmitting and receiving equipment. The transmitting equipment, which includes a radio transmitter and transmitting antenna and is

installed at the point from which messages are transmitted. The receiving equipment, which consists of a radio receiver and receiving antenna, is installed at the point at which messages are received.



10. The Indian Army utilizes various components in its radio communication systems to ensure efficient and secure communication for operations. The key components of radio communication in the Indian Army are as follows:-

(a) **Radio Transmitters and Receivers**. Transmitters are used to send signals across different frequencies. Receivers are used to receive signals from other communication devices. These devices can be portable (for infantry units), vehicle-mounted (for armored or mechanized units), or fixed (for headquarters or base stations).

(b) **Communication Radios**. The Indian Army uses different types of radios based on the operational requirement:

Type of Frequencies	Ranges	Remarks
HF (High Frequency) Radios.	Beyond 50-100 km	Long-range communication
UHF (Ultra High Frequency) Radios	Few Kilometers	Short-range communication
VHF (Very High Frequency) Radios.	between 30 to 50 km.	Communication between tactical units on the battlefield

(c) **Antennas**. Antennas play a crucial role in radio communication by transmitting and receiving signals. Depending on the type of radio, antennas vary in size and configuration:

(i) Whip Antennas: Common in handheld radios.

(ii) Long Wire Antennas: Used for HF radios.

(b) **Dish Antennas**. Used for SATCOM and high-frequency communications.

(c) **Radios in Vehicles**. Vehicles such as armored vehicles, trucks, and command centers are equipped with radios for communication during mobility

operations. These radios are often mounted in the vehicle and provide a stable communication link, even while moving.

Types of Wave

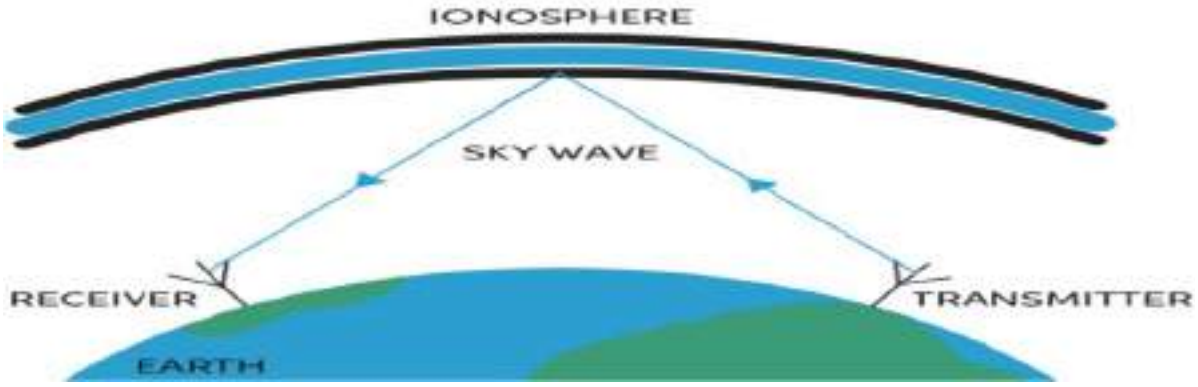
11. A wave can be described as a disturbance that travels through a medium from one location to another location. Types of waves can broadly be divided in two parts:-

(a) **Mechanical Waves**. A mechanical wave is a wave that is an oscillation of matter and therefore transfers energy through a medium.

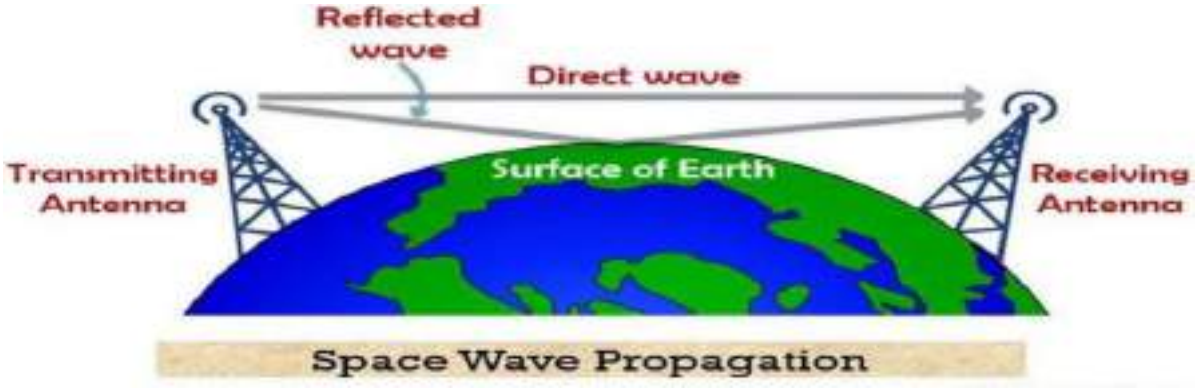
(b) **Electromagnetic Waves**. Electromagnetic waves are waves that can travel through the vacuum of outer space.

12. **Propagation of Wave**. The mode of propagation of electromagnetic waves (EMW) from transmitter to receiver depends upon the frequency employed. These can be of the following types:-

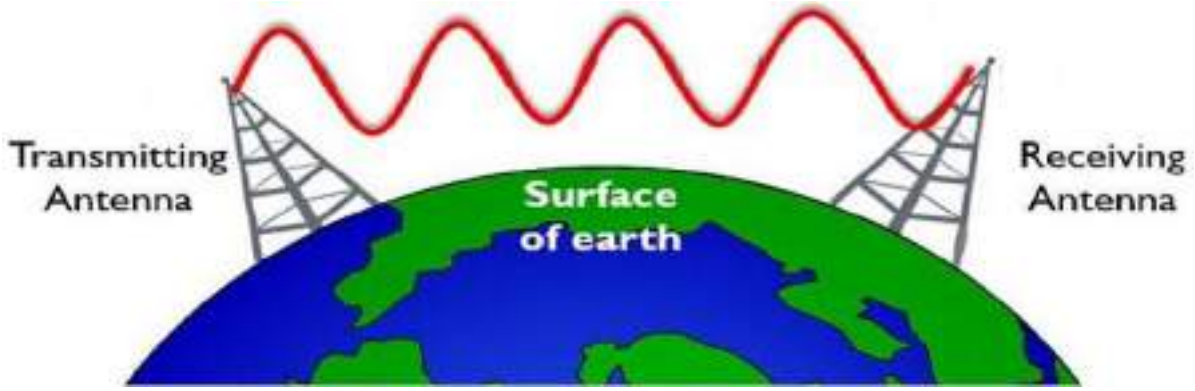
(a) **Sky Wave Propagation**. The sky waves are the radio waves that use an ionosphere layer existing to a height of 150 - 200 km from the surface of the earth and are reflected by the ionosphere of the earth's atmosphere.



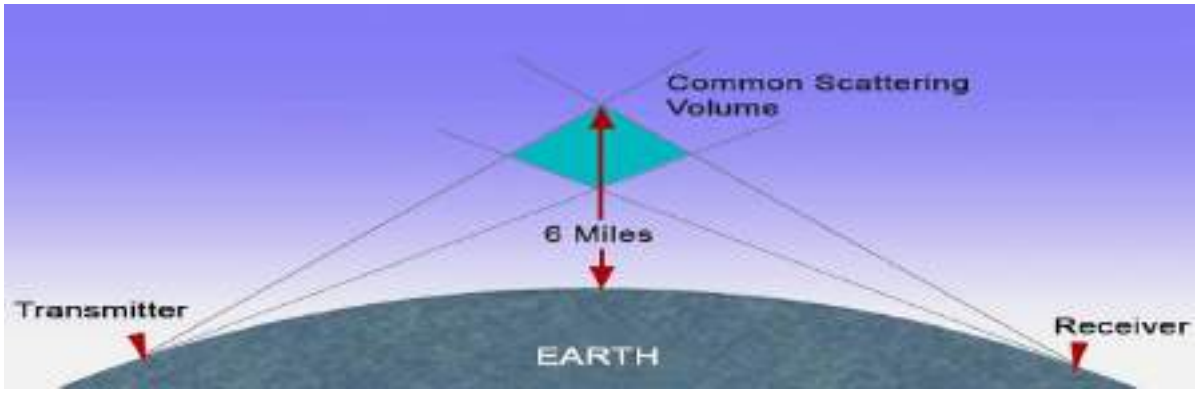
(b) **Space Wave Propagation**. Space waves can travel through the atmosphere from the transmitter antenna to the receiver antenna either directly or after reflection from the ground in the earth's troposphere region. Their range is limited by the curvature of the earth; therefore, the distance between two neighboring stations is approximately 50 Km.



(c) **Ground Wave Propagation**. It is a method of radio frequency propagation that uses the area between the surface of the earth and the ionosphere for transmission. Ground wave radio signal propagation is ideal for relatively short-distance propagation on these frequencies during the daytime with a limited range of approximately 30 km.



(d) **Tropospheric Scatter**. (Also known as troposcatter) It is a method of communicating with microwave radio signals over considerable distances – often up to 300 km and further depending on terrain and climate factors. Radio signals are transmitted in a narrow beam aimed just above the horizon in the direction of the receiver station. Communication distances are limited by the visual horizon to around 30–40 miles (48–64 km).



Radio Communication in Army

13. Radio communication in army is carried out in two ways namely Net Radio, which a number of subscribers are out station on a particular frequency and the communication is supervised by a Control. This type of communication is limited to a particular area and number of subscribers. However, the second way is Radio Relay, wherein a repeater radio set is used to enhanced the range of communication of two Net Radio networks.

14. **Net Radio**. Net radio is the basic signal communication for any mobile force. The efficiency of net radio communication is appreciably affected by factors such as weather, terrain, power output of the set, state of training of operators, and equipment maintenance. It provides facilities for the following:-

(a) **Radio Telephony**. Simple one-way voice communication, depending on the type of equipment available.

(b) **Data Transmission**. With the use of software and specially designed Laptops.

15. **Advantages of Net Radio**.

(a) Vulnerable only at the terminal and is therefore reasonably protected from enemy action except by a direct hit.

(b) It is flexible hence can be rapidly re-arranged in the event of regrouping.

(c) Rapid in establishing communication. Works on the move although the range obtained will be much less than when stationary.

(d) Economical in personnel and equipment.

16. **Disadvantages of Net Radio**.

(a) Inherently insecure and susceptible to enemy interception which necessitates the use of codes and ciphers with a consequent delay in clearing traffic and an overall increase in operating personnel.

(b) Net Radio being inherently insecure demands a considerable degree of security consciousness on the part of the users. This means adherence to standard procedures and security codes.

17. **Radio Relay**. Radio relay implies that a series of radio transmitters and receivers are normally spaced between 20-35 Km apart and are used to provide point signal communication at enhanced ranges by the use of repeaters.

18. **Advantages of Radio Relay**.

(a) Replace line with considerable economy of manpower and stores.

(b) It can be operated over the area where for reasons of ground or enemy activity use of line may not be possible.

(c) Provides greater flexibility than line.

(d) Quick to set up and move except in mountainous country.

(e) Ability to employ multichannel equipment radio relay provides more data circuits over one link than can normally be provided over the average field cable.

(f) It has a much greater traffic handling capacity.

19. **Disadvantages of Radio Relay**.

(a) Liable to interception and hence insecure.

(b) Has relatively greater security than net radio, depending upon the siting and direction of the beams.

(c) Liable to interference from enemy jamming although not as much as in the case of net radio.

(d) Terrain between stations must be reasonably suitable to get a ‘quasi-optical, this presents difficulty in siting.

(e) The location of terminal and intermediate stations may not suit the tactical layout and may, therefore, create additional protection requirements.

(f) It needs critical siting and cannot work on the move.

(g) Slightly more expensive in men and material than in the case of net radio.

20. Other more modern modes of communication are based on internet and Satellite Communication (SATCOM). These systems provide global communication capabilities, which are often used for secure, long-distance communication, which is done in digital formats. It does not require any physical connect within subscribers like line communication and has in built secrecy.

CONCLUSION

21. This is the basic means of signal communications for a static force. It is reliable, secure and practically free from electrical interference. Radio communication is flexible, works on move and can be established rapidly.

SUMMARY

- **Line**. This is the basic means of signal communications for a static force. It is reliable, secure and practically free from electrical interference. It is vulnerable to physical interference and enemy interception.
- **Radio Communication**. Radio communication involves Net Radio and Radio Relay. Net radio is the basic means of signal communication for any mobile forceand Radio communication is flexible, works on move and can be established rapidly. It is susceptible to enemy interception and requires use of codes, ciphers and standard procedures for voice communication. It is economical in terms of men and material than line communication.
- **Radio Relay**. Radio relay implies that a series of radio transmitters and receivers are normally spaced between 20-35 Km apart and are used to provide point to point signal communication. It is less liable to interference from enemy jamming in comparison to radio communication. Economical than line communication but more expensive than radio communication.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. Who invented the telephone?

(a) Issac Newton
(b) C.V. Raman
(c) Alexander Graham Bell
(d) Marie Curie

Q2. Which is a component of line communication?

(a) Telephone
(b) Trunk Media
(c) Local loop
(d) All of the above

Q3. How many types of waves are there?

(a) 2 (b) 3
(c) 4 (d) 5

Q4. How many types of propagation of electromagnetic waves are there?

(a) 2 (b) 3
(c) 4 (d) 5

Q5. Radio Communication involves?

(a) Net Radio
(b) Radio Relay
(c) Both A and B
(d) None of the above

Q6. Ionosphere is involved in which propagation of waves?

(a) Sky Wave
(b) Space Wave
(c) Ground Wave
(d) All of the above

Q7. Maximum communication distance can be achieved in which type of wave propagation?

(a) Sky Wave
(b) Space Wave
(c) Ground Wave
(d) Troposcatter

Q8. Minimum communication distance can be achieved in which type of wave propagation?

(a) Sky Wave
(b) Space Wave
(c) Ground Wave
(d) Troposcatter

Q9. The efficiency of Net Radio communication is affected by?

(a) Weather
(b) Terrain
(c) Power output of radio set
(d) All of the above

Q10. The efficiency of Net Radio communication is affected by?

(a) Weather
(b) Terrain
(c) Power output of radio set
(d) All of the above

Q11. There are how many types of Radio Communications?

(a) One
(b) Two
(c) Three
(d) Four

Q12. What does radio relay mean?

(a) Series of Radio Transmitters & Receivers
(b) Radio & Communication

Q13. Radio Relay implies a series of Radio Transmitters and Receivers which are normally spaced between which range?

(a) 10–15 km
(b) 20–35 km
(c) 15–20 km
(d) 40–50 km

Q14. What are the types of Radio Technology Communication?

(a) RT Conversation
(b) Formal Message
(c) Unregistered Message
(d) All of the above

Q15. Radio Communication involves the following:

(a) Open & Close
(b) Net Radio and Radio Relay
(c) Radio and Line
(d) Radio and Internet

Q16. What does radio relay mean?

(a) Series of Radio Transmitters & Receivers
(b) Radio & Communication
(c) Radio & Set
(d) Radio & Television

Short Answer Type Questions

Q1. What is Communication?

Q2. What are the components of line communication?

Q3. What are the basic components of Radio Communication?

Q4. What is Radio Communication?

Q5. What are the advantages of Line Communication?

Q6. What are the disadvantages of Radio Communication?

Long Answer Type Questions

Q1. What is Net Radio? What are the advantages and disadvantages of Net Radio?

Q2. What are the advantages and disadvantages of Line Communication?

Q3. What is Radio Relay? What are its advantages and disadvantages?

MILITARY COMMUNICATION (SD/SW)

CHAPTER MC II: BASICS OF RT PROCEDURE & PHONETIC ALPHABETS

TEACHING INSTRUCTIONS

Period : 04 (160 Mins)
Type : Lecture & Practice
Year : 2nd Year (02) & 3rd Year (02)
Conducting Officer : Permanent Instructor

Training Aids: Class Room, Computer with OHP, Screen, Pointer Staff, Presentation, Script/Book/Lesson Plan, Board and Markers.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 10 Mins**
- **Part II : 10 Mins**
- **Part III : 20 Mins**
- **Part IV : 20 Mins**
- **Part V : 20 Mins**
- **Conclusion and Summary : 05 Mins**
- **Practice : 80 Mins**

INTRODUCTION

1. The RT procedure is laid out to communicate on the Radio to make the conversation secure and successful, which is referred to as “Radio Telephony”. This procedure is very important to avoid confusion over the radio and is generally used by defence forces, air traffic controllers, maritime operators, and amateur radio operators. A radiotelephone is a two-way radio ie. both sides can speak. Most frequencies are simplex i.e. only one person can speak at a time. When you press the PTT (Press to Transmit) button the receiving circuit is cut off. i.e. you can speak but you can't hear that is why when person A has finished speaking, he says “Over”, meaning over to you, before releasing the PTT. Person B now has the mike. The conversation then goes back and forth which each person passing the mike by saying “over” when he has finished. At the end of the conversation when one person has had enough, he says “Out”.

INTERESTING FACTS

- **Radiotelephony means telephony by radio**.
- **Radiotelegraphy is radio transmission of telegrams and Television is transmission of moving pictures and sounds**.

OLD WALKIE-TALKIE DESIGN

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I: Basics of RT Procedures**
- **Part II: Phonetic Alphabets**
- **Part III: Characteristics of Walkie/Talkie**
- **Part IV: Standard Phrases**
- **Part V: Signal Strength**
- **Part VI: Practices of RT Procedure**

LEARNING OBJECTIVES

- **Understanding the basic principles of RT procedure,**
- **Advantages and disadvantages of RT communication**
- **Learning the universal phonetic alphabet**
- **Learn characteristics/features of GP 338 walkie talkie**
- **Learn basic control and handling of walkie-talkie**

PART I: BASICS OF RADIO TELEPHONY

2. The principles of Radio Telephony (R/T) in the Indian Army are focused on effective communication, ensuring clear and secure exchanges of information during operations. These principles guide the use of radio communication equipment in a disciplined and systematic manner to maintain operational readiness and coordination. It is a set of rules which is used to maintain security, speed and accuracy while sending news. It helps us to eliminate errors caused by different languages and dialects.

3. **Principles of Radio Telephony Procedure**. BASS defines the Principles of RT procedure. These include:-

(a) **B – Brevity**. All transmissions should be as short as possible so that the enemy cannot easily intercept them and time is not wasted in sending unnecessary messages. Avoid unnecessary words and ensure the message is easily understood. This is critical in the field, where time and clarity can be of the essence.

(b) **A – Accuracy**. Messages should be repeated back (read-back) to confirm they have been understood correctly. This ensures that no information is missed or misunderstood. If the meaning of the fixed correct words or digits/letters is known to both the speaker and the listener, then there will be fewer errors.

(c) **S – Security**. If the meaning of the fixed correct words or digits/letters is known to both the speaker and the listener, then there will be fewer errors. Sensitive information should be encrypted or transmitted in a secure manner to prevent interception by adversaries and operational security Radio operators should always maintain strict security protocols, such as avoiding the transmission of sensitive details over unsecured channels. If each unit uses its own specific modus operandi, the enemy will become familiar with their habits and will quickly recognize them.

(d) **S – Speed**. Radio equipment must be regularly tested and maintained to ensure it is operational at all times. This includes both hardware checks and frequency management to avoid interference. Stations must constantly monitor radio frequencies to receive any incoming messages or signals, ensuring no communication is missed during critical operations. By setting a system and rule for any work, that work can be done faster because it becomes easier for the speaker to say and the listener to understand.

4. In summary, the principles of Radio Telephony in the Indian Army revolve around clarity, security, discipline, and effectiveness in communication. These principles ensure that radio communication supports operational efficiency and helps maintain coordination and command in the field. In this section we will understand the definitions of the terms that are used in Radio Telephony Procedure (RT Procedure).

(a) **Radio Telephony Procedure (RT Procedure)**. It is a set of rules which is used to maintain security, speed and accuracy while sending news. It helps us to eliminate errors caused by different languages and dialects.

(b) **Code Sign and Link Sign**. To conceal the identity of the information giving and information receiving station, we use code sign and link sign.

(c) **Code Sign**. A group of three words which hides the identity of a unit/formation/headquarters. These are given by the above formation. For example, ABC, this can be the code sign of a battalion.

(d) **Link Sign**. It is made by adding numbers along with code sign, which hides the identity of the radio station. Like ABC 1- it can be the link sign of the company of the same battalion.

(e) **Appointment Code**. hides the rank of the officer/level of the commander. For example:- Battalion commander is also a tiger and section commander is also a tiger, 2IC of the Bn is known as Lamb.

(f) **Standard Phrases**: This is a group of words whose meaning is considered standard in the army. By using these, the sender understands the true meaning of the message without any delay.

(g) Proper management of radio frequencies is essential to avoid congestion and ensure effective communication. Military communications often use different frequency bands, and it's critical to stick to assigned frequencies to avoid interference with other units or external signals.

(h) Only authorized personnel should operate the radio equipment. Unauthorized transmissions should be avoided.

(j) Radio communication must also ensure proper coordination between different arms and units, such as infantry, artillery, and armored units, to execute coordinated operations effectively.

5. Various advantage/disadvantage RT procedure and radio communications are as under:-

(a) **Advantages**. It is easy to establish, flexible and enables transmissions to more than one station.

(b) **Disadvantages**. Easier to intercept, liable to atmospheric interference and interference from other stations, liable to be jammed and requires trained operators.

6. **Need for Standard Procedure**. Standard procedure in RT is needed to attain speed, uniformity, and security and prevent misunderstanding & confusion by use of code signs, link signs, etc. which hides the identity of an operator and that of a unit.

7. **Important Points to Remember During RT Communication**. RSVP is the key word which is to be kept in mind while making radio telephony communication:-

(a) R- Rhythm (b) S- Speed

(c) V- Volume (d) P- Pitch

8. **Types of RT Communication**.

(a) **RT Conversation**. This is the normal conversation between radio operators, which is not registered.

(b) **Unregistered (UR) Message**. The only record taken will be in the radio operator’s logs of the sender and receiver.

(c) **Formal Message**. It is written down and signed by the originator will be written on a message form (IAFU-4009).

PART II: PHONETIC ALPHABETS

9. Human beings with their higher intellect have successfully developed and evolved various forms of communications like, sign language, voice, written script, line transmission, radio wave, space wave and highly complex digital communication forms. The various means of communication adopted are as under:-

(a) **Voice Medium**. The development and graduation of sign to voice has also evolved, as voice is a very powerful means of communication, however this had its own disadvantages of limited reach. This was further restricted because of the loudness, pitch and ability of the speaker/ transmitter and the hearing ability of the receiver. It is also affected by other factors such as interference of surrounding sounds, noise pollution, echoing and attentiveness of the listener.

(b) **Written Script**. Once languages were formalised and some commonality in understanding of each other had been achieved, it appears that written script made a beginning. The earliest form of written expression can be found on the rock engravings of ancient scriptures in pictorial form. This gradually developed into alphabetic form and written script. Once the script had been evolved, messages could be communicated from the one person to another in written form.

(c) **Phonetic Alphabets**. Using a phonetic alphabet can increase communication accuracy and efficiency when there is a lot of background noise and when people speak different languages or dialects. The use of a phonetic alphabet (like Alpha for A, Bravo for B, etc.) helps avoid confusion over poor signal quality or noisy environments. The phonetic Alphabets are as under:-

PHONETIC ALPHABETS

A = ALFA	B = BRAVO	C = CHARLIE
D = DELTA	E = ECHO	F = FOXTROT
G = GOLF	H = HOTEL	I = INDIA
J = JULIETT	K = KILO	L = LIMA
M = MIKE	N = NOVEMBER	O = OSCAR
P = PAPA	Q = QUEBEC	R = ROMEO
S = SIERRA	T = TANGO	U = UNIFORM
V = VICTOR	W = WHISKY	X = X RAY
Y = YANKEE	Z = ZULU	

The concept of pronouncing of Signal codes are spoken by the sender such as "ALPHA", this means that receiver understands as English word "A".

PART III: CHARACTERISTICS OF WALKIE/TALKIE

10. **Definitions**

(a) **Radio Net**. Stations working on the same frequency to communicate with each other comprise a Radio Net.

(b) **Control Station**. Station serving as the senior HQ in the Radio Net. It is responsible for the establishment of communications and maintains radio discipline on the net.

(c) **Link Sign**. It is a secret group of letters or a combination of letters and figures, allotted to a station on the radio net, for concealing the identity of the communicating station. Link signs are changed daily or even earlier if required.

(d) **Code Sign**. It is a three-letter group allotted to HQ/formation or unit to conceal their identity. These are changed daily.

(e) **Long Message**. Message that lasts for more than half a minute generally consists of more than thirty groups.

(f) **Short Message**. A short message lasts for half a minute or less.

(g) **Standard Phrases**. The use of standard procedure ensures that the exact meaning of a sender is conveyed to the receiver in a minimum time.

(h) **Code Word**. A code word is a single word used to provide security cover for reference to a classified matter.

(j) **Nicknames**. A nickname consists of two separate words that do not bear any relationship to each other i.e. PAHAD BANDAR. Nicknames have very little security value and are used for convenience.

11. **Types of Calls**. Calls can be categorised as under:-

(a) **Single Call**. A call when only one station on a net is addressed by any station of the net.

(b) **Net Call**. A call is used to address all stations on a net e.g. “All stations Alpha”.

(c) **Multiple Calls**. A call when two or more but not all stations on the net are addressed. The pro word “and” will be inserted between the last two call signs e.g. `A1 for A2 and A3'.

(d) **Net Call with Exceptions**. A call used to address all stations on the net except a few. Here a net call is made and stations not called are specified e.g. “all stations Alpha except ABC 3”.

PART IV: STANDARD PHRASES

12. **Standard Phrases**. This is a group of words whose meaning is considered standard in the army. By using these, the sender understands the true meaning of the message without any delay. Some examples are as follows:-

(a) Hello - A way to draw attention to yourself.

(b) Correction - The last word of the message just sent is wrong, this is the correct one.

(c) SAY AGAIN - The receiver of the message asks for a repeat.

(d) I SAY AGAIN- I say it again.

(e) Roger - I have heard and understood the message.

(f) WILCO - The message has been heard, understood and implemented

(g) SO FAR - Reply to the messages sent so far, there are more messages to come.

(h) WAIT - Wait a few seconds.

(j) WAIT OUT - Wait for the next order.

PART V: SIGNAL STRENGTH AND TYPE OF CALLS

13. **Signal Strength**. Signal strength received during Radio Telephony conversations is classified as under:-

(a) **One**. The signal is very weak and not readable.

(b) **Two**. The signal is weak, and readable now and then.

(c) **Three**. The signal is fairly good and readable with difficulty.

(d) **Four**. The Signal is Good and readable.

(e) **Five**. The signal is very good and perfectly readable.

14. **Net Discipline**. Net discipline while making RT calls is most important for better and smoother communication. The following points must be followed to maintain the Net Discipline:-

(a) Follow the instructions of the Control Station.

(b) All Stations should respond in sequence.

(c) Give priority to the message.

(d) Without sequence do not answer

15. **Documentation**. Documentation forms a very important aspect of the RT procedure. All events need to be documented for future reference in case of a query.

16. **Rules on Security**. Security over radio is an important issue in defence forces hence there is a need to adopt these procedures and follow certain golden rules:-

(a) Think before you speak.

(b) Use the correct procedure.

(c) Avoid the use of jargon.

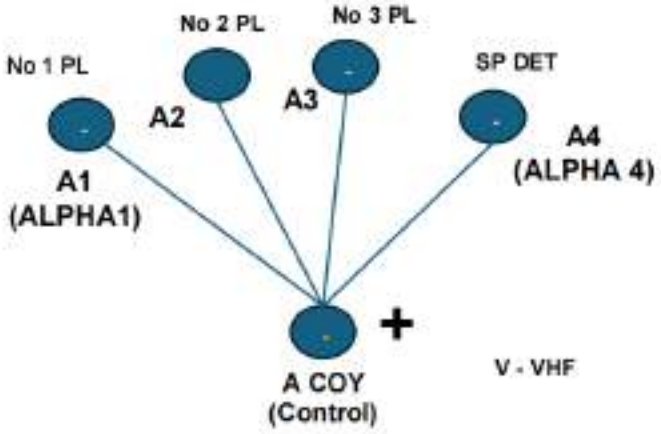
(d) Use official codes only.

(e) Substitute clear names with code signs.

(f) Be brief.

PART VI: PRACTICE OF RT PROCEDURE

17. **Basic Radio Net Diagram with Link Signs**.



18. **Basic Conversations**.

(a) **Control Station (+):** All Stations Alpha Report **Over**

(b) A1 Outstation: Alpha 1 Ok **Over**

(c) A2 Outstation: Alpha 2 Ok **Over**

(d) A3 Outstation: Alpha 3 Ok **Over**

(e) A4 Outstation: Alpha 4 Ok **Over**

(f) **Control Station(+):** All Stations Alpha Report Your Signal Strength **Over**

(g) A1 Outstation: Alpha 1 Strength 4 **Over**

(h) A2 Outstation: Alpha 2 Strength 2 **Over**

(i) 3 Outstation: Alpha 3 Strength 5 **Over**

(k) A4 Outstation: Alpha 4 Strength 3 **Over**

(l) C**ontrol Station (+):** All Stations Alpha By 1400h Send Your Ammunition Demand **Over**

(m) A1 Outstation: Alpha 1 Roger **Over**

(n) A2 Outstation: Alpha 2 Roger **Over**

(o) A3 Outstation: Alpha 3 Roger **Over**

(p) A4 Outstation: Alpha 4 Roger **Over**

(q) **Control Station (+):** All Stations Alpha Report Your Troop Strength As On Date And Forward Your Kerosine Demand For Next Month By 1700h **Over**

® A1 Outstation: Alpha 1 Wilco **Over**

(s) A2 Outstation: Alpha 2 Wilco **Over**

(t) A3 Outstation: Alpha 3 Wilco **Over**

(u) A4 Outstation: Alpha 4 Wilco **Over**

(v) **Control Station (+):** All Stations Alpha Nothing Else **Out**

CONCLUSION

19. Radio Telephony" procedure is very important to avoid utter confusion over the radio and is generally used by defence forces, air traffic controllers, maritime operators, and amateur radio operators. A radiotelephone is a two-way radio ie. both sides can speak. Most frequencies are simplex ie only one person can speak at a time.

SUMMARY

- **Radio Telephony**. The procedure laid out to communicate on the Radio so as to make the conversation secure and successful, which is referred to as "Radio Telephony". The Principles of Radio Telephony Procedure are:-
  - B – Bravity
  - A – Accuracy
  - S – Security
  - S – Speed
- A walkie-talkie is a hand-held, portable, two-way radio transceiver which operates in VHF and UHF mode.
- **Facilities/ Features**. The following are the facilities/features in handheld Radio set GP338:-
  - It is portable and light in weight. It can be operated easily and so operated in VHF/UHF and 2-way simplex mode. It has 128 channels of this radio set can be preset into 8 zones. Option of selective call facilities available.
  - A call alert can be given to the receiver station. It can select the required zone.
  - In addition, Start/stop facilities of scan operation available to Add/Delete from scan list facilities available.
- **Communication Range**. The range radio set with repeaters it can work from Principles of Radio Telephony Procedure.
  - Without repeater – 4 to 5 km
  - With repeater – 20 to 40 km
- **Power Output**. It has Power output (HF) of 1 to 5 watts and Power output (UHF) 1 to 4 watts.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What is the full form of RT?

(a) Radio Transmitter
(b) Radio Transfer
(c) Radio Term
(d) Radio Telephony

Q2. The keyword for principles of Radio Telephony is known as?

(a) BAAS
(b) BASS
(c) BOSS
(d) BAUS

Q3. The keyword for Radio Telephony Procedure is known as?

(a) RSPV
(b) RSVP
(c) VPRS
(d) Non of above

Q4. How many phonetic alphabets are there?

(a) 22
(b) 26
(c) 20
(d) 28

Q5. How many types of calls are there?

(a) One
(b) Two
(c) Three
(d) Four

Q6. A secret group of letters and figures allotted to a station in the radio net is called?

(a) Code Sign
(b) Link Sign
(c) Code Word
(d) Nickname

Q7. Letter group allotted to an HQ/Formation/Unit to conceal identity in the radio net is called?

(a) Link Sign (b) Code Sign
(c) Nickname (d) Code Word

Q8. A single word used to provide security cover for reference to a classified matter is called?

(a) Link Sign (b) Code Sign
(c) Code Word (d) Nickname

Q9. Code Sign and Link Sign are used in radio procedures to:

(a) Conceal the identity of the information
(b) Conceal the name of the instrument used for communication
(c) Describe the name of the sender
(d) Facilitate the enemy about the message

Q10. Two separate words (e.g., *PAHAD BANDAR*) that don't bear any relationship and have very little security value are called?

(a) Link Sign
(b) Code Sign
(c) Code Word
(d) Nickname

Q11. What is the standard phrases used in RT procedures?

(a) Over
(b) Roger
(c) Wilco
(d) All of the above

Q12. A message that lasts for half a minute or less is called:

(a) Long Message
(b) Short Message
(c) Medium Message
(d) Both (b) and (c)

Q13. What is the appointment code of a Commander?

(a) Eagle
(b) Sheep
(c) Tiger
(d) Lion

Q14. What phrase used in RT procedure for "My transmission has ended and I do not expect to hear a further transmission from you on this subject" is called:

(a) Out
(b) Over
(c) Over and Out
(d) Wait Out

Q15. Phrase used in RT procedure for “Message received and understood” is called:

(a) Ok
(b) Understood
(c) Roger
(d) Wilco

Short Answer Questions

Q1. What are the rules used for security on the radio?

Q2. What is radio telephony procedure?

Q3. What is Radio Telephony? Write the advantages of RT.

Q4. What is advantage of appointment code?

Q5. What are the types of Calls? Define each of the following types.

Q6. What is Call?

Q7. How many types of Call?

Long Answer Questions

Q1. What is the principles of Radio Telephony Procedure?

Q2. What are the standard phrases used in the RT Procedure?

Q3. What are the important points to remember during Radio Telephony?

MILITARY COMMUNICATION (SD/SW)

CHAPTER MC III: WIRELESS COMMUNICATION & LATEST TRENDS IN COMMUNICATION

"Soldiers can solve 98 percent of their problems by just talking to someone about them. All you have to do is listen."(SMA William G. Bainbridge).

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture**
Year	**:**	**2nd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, Computer with OHP, Screen, Pointer Staff, Presentation, Script or Book Flagged or Lesson Plan in File, Board, and Markers.

Time Plan

- **Introduction : 03 Mins**
- **Part I : 10 Mins**
- **Part II : 10 Mins**
- **Part – III : 15 Mins**
- **Conclusion and Practice : 02 Mins**

NTRODUCTION

INTERESTING FACTS

- **Wi-Fi stands for Wireless Fidelity which is a wireless technology standard for wireless Internet access**.
- **A Wi-Fi network is simply an internet connection shared with multiple devices in a home or business via a wireless router. The router is connected directly to your internet modem and acts as a hub to broadcast the internet signal to all your Wi-Fi-enabled devices**.

HOME WIRELESS NETWORK DIAGRAM

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I: Wireless Communication**
- **Features and Benefits.**
- **Part II: Terminal Equipment and Limitations of Wi-Fi.**
- **Part III: Latest trends and development in communication**.

LEARNING OBJECTIVES

- **Learn about Wireless communication, its features and benefits**.
- **Learn terminal equipment being used for Wi-Fi**.
- **Understanding limitations of Wi-Fi technology**.
- **Learn latest trends and development in communication**.

PART I: WIRELESS COMMUNICATION

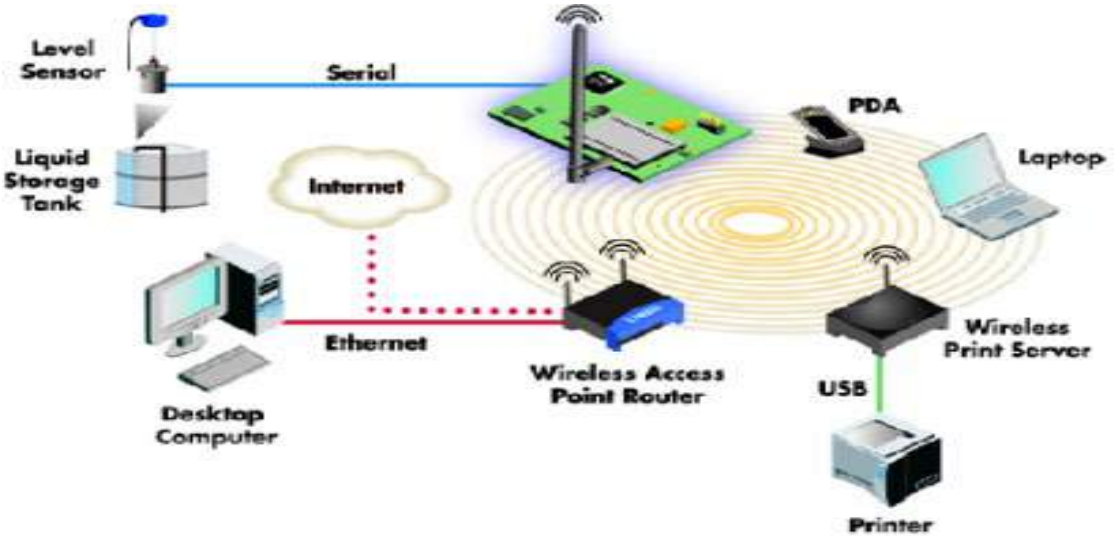
1. Wireless communication provides its users with the liberty of connecting to the internet from any place such as their home, office, or a public place without the hassles of plugging in the wires. It is quicker than the conventional modem for accessing information over a large network. Wi-Fi uses a radio network to transmit data between its nodes. Such networks are made up of cells that provide coverage across the network. The more the number of cells, the greater and stronger the coverage on the radio network.

Features and Benefits of Wireless Technology

2. Wireless communication operations permit services, such as long-range communications, which are impossible or impractical to implement with the use of wires. Information is transferred in this manner over both short and long distances. The following list summarizes some of the benefits of a Wireless network:-

(a) **Unmatched Mobility and Elasticity**. Wireless communication allowing the new intensity of connectivity without giving up functions. Wi-Fi introduced various types of utilities such as music streamers that transmit your music to speakers without

any wire you can also play music from the remote computer or any other attached to the network. The Wi-Fi technology system is remarkable, as a user can download songs, send an email and transfer files expediently at phenomenal speed even whilst the user is on the move.



(b) **Fortress Technology**. Wi-Fi supports secure wireless solutions and ensures the privacy of the user's data.

(c) **Support an Entire Age Bracket**. Wi-Fi technology has several advantages, it supports an entire age bracket creates a connection between components on the same network can transfer data between devices, and enables different kinds of devices such as games, MP3 players, PDA, and much more.

(d) **Convenient and Available Everywhere**. Wi-Fi is a convenient technology and where the network range station exists you are online during travel. You can equip yourself with a Wi-Fi network and get connected. You will automatically connect to the internet if you are near a hotspot. These days Wi-Fi exists everywhere with all its wonders.

(e) **Faster and Secure**. With Wi-Fi, you can get a high speed of internet because it is much faster than a cable connection you can establish a Wi-Fi network in a small space now you don't need any professional installation just connect to a power outlet with an Ethernet cord, and start browsing. Wi-Fi security system for Threats makes it more renewable and its tool protects your VPN and secure web page. You can easily configure the device to take better performance. The standard devices, embedded systems, and network security make it more powerful.

(f) **Wi-Fi with no limitation**. You can use a "Wi-Fi" network with no limitations because it can connect you worldwide. You can easily cater to your requirements with Wi-Fi networking applications because the power consumption is not very high compared to other bandwidth networks. The future of wireless internet network communications is bright.

(g) **Extension of Wi-Fi Technology**. It is because of this wireless technology that so many other advancements could take place. Have you ever thought of your TV to be supported by Wi-Fi? Well, if you didn't, start thinking now. There are smart TVs

in the market that connect to the internet. Having the internet on TV makes it possible to watch YouTube videos, Netflix and so much more. Read more about Wi-Fi TV technology on the World Wide Web.

(h) **Cost Reduction**. As mentioned above, the absence of wires and cables brings down costs.

(j) **Flexibility**. Extended access, cost reductions, and mobility create opportunities for new applications as well as the possibility of creating new solutions for legacy applications.

PART II: TERMINAL EQUIPMENT AND LIMITATIONS OF WI-FI

3. Emerging communication trends and issues are the new or evolving developments and challenges that affect the communication environment, such as technology, media, culture, politics, and society. Wi-Fi technology may not be efficient to perform the commutations. while wireless transmission media offer many advantages, they also have several limitations. These include interference from other devices and physical obstacles, security risks, limited range, and lower speeds compared to wired connections.

4. **Mobile Telephones**. One of the best-known examples of wireless technology is the mobile phone, also known as a cellular phone, with more than 8.9 billion mobile cellular subscriptions worldwide as of the end of 2024. These wireless phones use radio waves from signal-transmission 2025 towers to enable their users to make phone calls from many locations worldwide.

5. **Wireless Data Communications**. Wireless data communications are an essential component of mobile computing. The various available technologies differ in local availability, coverage range, and performance, and in some circumstances, users must be able to employ multiple connection types and switch between them.

6. Wi-Fi technology is not perfect and has many flaws that limit its use as follows:-

(a) **Security** Because wireless transmissions can pass through walls, security is an issue.

(b) **Wireless Reception**. Varies from area to area, even within your apartment. It's not always guaranteed that you'll have a connection to the Internet.

(c) **Interference**. Call quality is greatly influenced by the environment, and is particularly sensitive to electromagnetic radiation generated by other household appliances.

(d) **Compatibility Issue**. Despite global standardization, many devices from different manufacturers are not fully compatible, which in turn affects the speed of communication.

DID YOU KNOW?

- India’s communication satellites, primarily under the GSAT and INSAT series play a vital role in communication infrastructure.

PART III: LATEST TRENDS AND DEVELOPMENT IN COMMUNICATION

7. **Troposcatter, Modem, Fax, Data Troposcatter**. The lower layer of the atmosphere below 15Km height is called a tropospheric region. Communication carried out in this layer uses the principle of troposcatter. In this system, microwaves are transmitted in the Ultra High Frequency (UHF) and Super High Frequency (SHF) bands to achieve Radio Communication over the horizon covering a range between 70 Km to 1000 Km.

8. **MODEM (Modulator-Demodulator)**. This device is used to convert computer-generated output (Digital signals) that can be transmitted on a telephone line. Modems are required at both the sending and receiving computers.

9. **FAX**. This is the common short form of FACSIMILE which is one of the memory-type electronic mail and message systems with the following advantages:-

(a) Can transmit graphics as well as Alphanumeric information (letters and numbers).

(b) Reduce time and eliminate transmission error.

(c) Use any transmission medium e.g. Telephone, line, micro radio wave.

10. **Satellite**. An object that revolves around another larger object whose motion is primarily and permanently determined by the force of attraction of the body is known as a satellite. Satellites are used for many purposes. Common types include military and civilian Earth observation satellites, communications satellites, navigation satellites, weather satellites, and space telescopes. Space stations and human spacecraft in orbit are also satellites. Satellite orbits vary greatly, depending on the purpose of the satellite, and are classified in several ways. Well-known (overlapping) classes include low Earth orbit, polar orbit, and geostationary orbit.

11. **Types of Satellite**.

(a) Weather Satellite.

(b) Scientific Satellite.

(c) Communication Satellite.

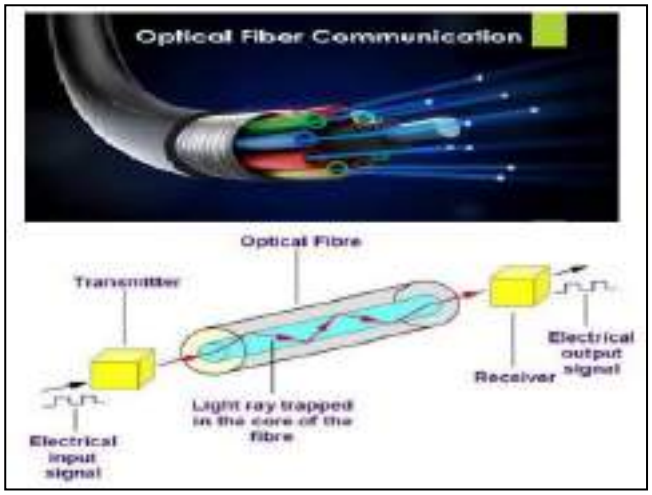
(d) Navigational Satellite

(e) Military Satellite.

12. **Communication through Optical Fibre Cable**. Hollow tubes made of corning glass with an outer protective coating of rubber/plastic etc. are what constitute optical fibers. These fibers are very delicate and small in diameter. The advantages and disadvantages are as under:-

(a) **Advantages**. It has a wide bandwidth carrying different types of information from low-speed voice signals to high-speed computer data. Less power requirement, small cable size and no electromagnetic interference.

(b) **Disadvantages**. It is expensive in terms of equipment and manufacturing. Requirement of experts to run the system always needed.



13. **Cell Phone**. The Cellular radio network was first introduced in Tokyo in 1979. It provides mobile subscriber access to the global telephone network. It is a rapidly expanding technology with high rates of obsolescence. The advantages and disadvantages are as under:-

(a) **Advantages**. Cell phone has more subscribers and traffic capability. There is no perceptible difference between mobile and fixed subscribers. It has better quality of service, higher speed of data exchange and can be used in an integrated mode with the computer network.

(b) **Disadvantages**. The cell phone is a open source. It can be jammed if required. Repeated charging of battery is required, it has many security-related issues so works on the capability and commercial interests of the service provider. It has health hazards due to excessive radiation.

14. **Internet**. Millions of computers all over the world are interlinked through telephone lines, satellites, submarine cables, and optical fiber networks. This World Wide Web (www) is what is called the “Internet”. It provides an instant, trouble-free, and cheap means of communication. The Internet is therefore a collection of individual data networks connected in such a way that data can be exchanged back and forth between networks widely separated. Electronic Mail, web browsing, and Voice Mail are the main facilities of the Internet.

15. **Multimedia**. It is a computer technology that displays information using a combination of full-motion video animation, sound graphics, and text with a high degree of user interaction.

16. **Video-Conferencing Systems**. These provide the full benefits of face-to-face communication with sound, graphics, and simultaneous transmission of data. The system enables people widely separated geographically to interact without having to meet in one place.

17. **Videophone**. It is a system that enables us to transmit an image via a digital telephone network, making visual contact has been made possible over great distances, apart from transferring speech. Facilities provided by videophone are:-

(a) Can transmit speech as well as colour video.
(b) Conduct of video conferences.
(c) Called subscriber is seen on the monitor.
(d) High quality of voice.
(e) Speed of sending/ receiving can be adjusted by the user.
(f) Map overlays can be transmitted.

CONCLUSION

18. Today technology has advanced in all spheres of life. Even the defence forces are well poised to exploit the state-of-the-art modern communication techniques to meet the requirements of the Indian Army in the 21st century. Some of the areas that the army is already in the process of exploiting are Cellular Radio (both GSM & CDMA), WLL, mobile trunked radio, mobile satellite systems, OFC, and so on. Therefore, it is very important to be well-versed with the latest trends in information technology to gain maximum advantages from the same.

SUMMARY

- **Wireless**. Wireless operations permit services, such as long-range communications, that are impossible or impractical to implement with the use of wires.

- **Mobile Telephones**. These wireless phones use radio waves from signal-transmission towers to enable their users to make phone calls from many locations worldwide.
- **Wireless Data Communications**. Wireless data communications are an essential component of mobile computing. The various available technologies differ in local availability, coverage range, and performance.
- **Wi-Fi**. Wi-Fi is a wireless local area network that enables portable computing devices to connect easily to the Internet. Wi-Fi has become the de facto standard for access in private homes, within offices, and at public hotspots. Cellular data service offers coverage within a range of 10-15 miles from the nearest cell site.

- Troposcatter is a system in which microwaves are transmitted in the UHF and SHF band to achieve radio communication over the horizon covering a range between 70 Km to 1000 Km.
- A modem (modulator-demodulator) is a network hardware device that modulates one or more carrier wave signals to encode digital information for transmission and demodulates signals to decode the transmitted information.
- A satellite is an artificial object which has been intentionally placed into orbit. Such object is sometimes called artificial satellites to distinguish them from natural satellites such as Earth's Moon.
- Satellites are used for a large number of purposes. Common types include military and civilian earth observation satellites, communications satellites, navigation satellites, weather satellites, and research satellites.
- Multimedia is content that uses a combination of different content forms such as text, audio, images, animation, video, and interactive content. Multimedia contrasts with media that use only rudimentary computer displays such as text-only or traditional forms of printed or hand-produced material.

ASSESMENT EXERCISE

Multiple Choice Question

Q1. Important features of Wi-Fi involve which undermentioned option?

(a) Mobility
(b) Fortress Technology
(c) Cost Reduction
(d) All of the Above

Q2. Limitations of Wi-Fi Technology is which undermentioned option?

(a) Security
(b) Interference
(c) Wireless Reception
(d) All of the Above

Q3. The lower layer of the atmosphere below ___ km is called the tropospheric region.

(a) 15 km
(b) 48 km
(c) 64 km
(d) 30 km

Q4. What advantages does Optical Fibre Communication offer?

(a) High Speed
(b) Less Power Requirement
(c) No Interference
(d) All of the Above

Q5. The cellular radio network was first launched in which year?

(a) 1979
(b) 1980
(c) 1983
(d) 1985

Q6. Which of the following is not a communication satellite?

(a) CARTOSAT-3
(b) GSAT-10
(c) GSAT-7C
(d) INSAT-3A

Q7. Which of the following is not part of Information Technology?

(a) Computer (b) Internet
(c) Telephone (d) Email

Q8. MODEM is used for transmitting digital signals over?

(a) Radio Set (b) Email
(c) Mobile Phone (d) Telephone Lines

Q9. Which of the transmission media cannot be used by FAX?

(a) Microwave Radio (b) Telephone
(c) Line (d) Hand Held Radio Set

Q10. Which application can be used for video conferencing?

(a) Google Meet
(b) Cisco Webex
(c) Zoom
(d) All of the Above

Q11. What is the benefit of Wi-Fi?

(a) Power Saving
(b) Cost Less
(c) Mobile Data
(d) Small Set

Q12. Video Conferencing can be held on _____?

(a) Motorola
(b) Telephone
(c) Wi-Fi Network
(d) Radio Set

Q13. This word 'www' is what is called the “Internet”.

(a) World Wide Web
(b) World War
(c) Wide Area Web
(d) Work Web for Net

Q14. Wi-Fi Network is ……?

(a) Slow and secure
(b) Faster and secure
(c) Limited to LAN
(d) Need Radio Set

Q15. Video Conferencing is useful for _____?

(a) Distance Talk
(b) Office Complex
(c) Wi-Fi Network
(d) Radio Set

Short Answer Questions

Q1. What is MODEM?

Q2. What is the Internet?

Q3. What is Tropo Scatter?

Q4. What is Fax?

Q5. What is Satellite?

Q6. What is Information Technology?

Q7. What is Multimedia?

Long Answer Questions

Q1. What is Wi-Fi? Write the benefits of a Wi-Fi Network.

Q2. What is Optical Fibre? Write the advantages of Optical fiber Cable

Q3. What are the features of Wi-Fi Technology?

Q4. What are the advantages of video phones?

MAP READING

4

CHAPTER WISE INDEX: MAP READING

MAP READING

CHAPTER MR-I: INTRO TO MAPS AND CONVENTIONAL SIGNS, SCALES & GRID SYSTEMS

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture and practice**
Year	**:**	**1st year SD/SW**
Conducting officer	**:**	**permanent instructor**

Training Aids:

Classroom, Open Training area or Ground, Computer with OHP, Screen, Pointer Staff, Presentation, Script or Book Flagged or Lesson Plan in File, Board and Markers, Map Sheets, Scales and Map reading Charts

Time Plan:

➢ **Introduction**	**:**	**05 Mins**
➢ **Part I**	**:**	**10 Mins**
➢ **Part II**	**:**	**05 Mins**
➢ **Part III**	**:**	**05 Mins**
➢ **Part IV**	**:**	**10 Mins**
➢ **Conclusion**	**:**	**05 mins**

INTRODUCTION

1. Map Reading is an essential part of services training; it not only assists youth with methods of understanding surroundings but also paves the way for planning and executing any task given to a leader in the future. The study of maps helps in navigation and other daily activities in all civil affairs. Knowledge of grids and finding GR helps in finding the location of objects accurately. A good sense of directions, conventional signs and scales helps in finding out own location and location of objects. Map is true friend of soldier in battle field.

"We must navigate the stars, not the light of every passing ship."- Gen Omar Bradley

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in the following parts:- ➢ **Part I: Definition and Types of Maps & Conventional signs**. ➢ **Part II: Division of Indian sub-continent to map zones**. ➢ **Part III: Definition and methods of expressing scale and scale line Scale and grid system**. ➢ **Part IV: Definition of Grid and method of finding grid reference**.	➢ **To learn the basics of Map reading and conventional signs**. ➢ **Understand Division of Indian sub-continent to map zones**. ➢ **Comprehend scale and grid system Understanding Grid reference**.

PART: I DEFINITION AND TYPES OF MAPS & CONVENTIONAL SIGNS

Definition of Map:

2. A map is a representation of the features of the ground on a piece of paper or plain surface with the help of conventional signs on a particular scale. A map, however, has the following limitations:-

(a) Map details are correct only up to the given date of recording, as features on ground keep changing or getting added.

(b) As the map is two-dimensional, it cannot depict all features on the Earth's surface exactly.

3. **Types of Maps**

(a) **Physical Map**. This is a map that shows the natural features of a specific place, such as mountains and deserts.

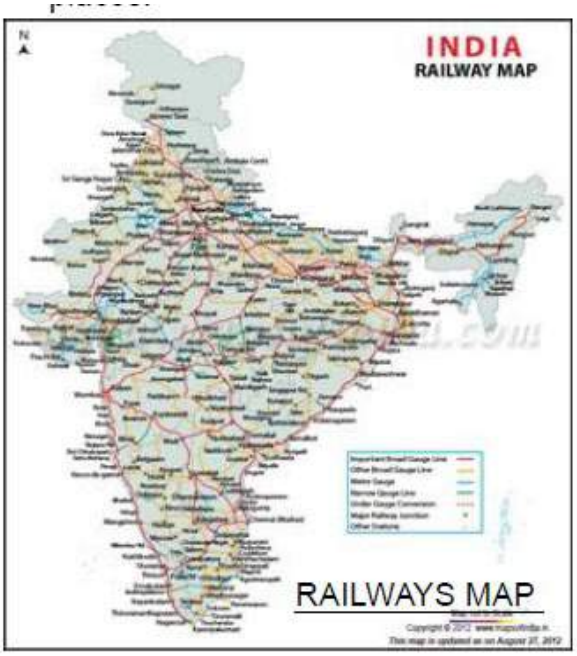
(b) **Political Map**. These maps represent the borders of different states and countries.

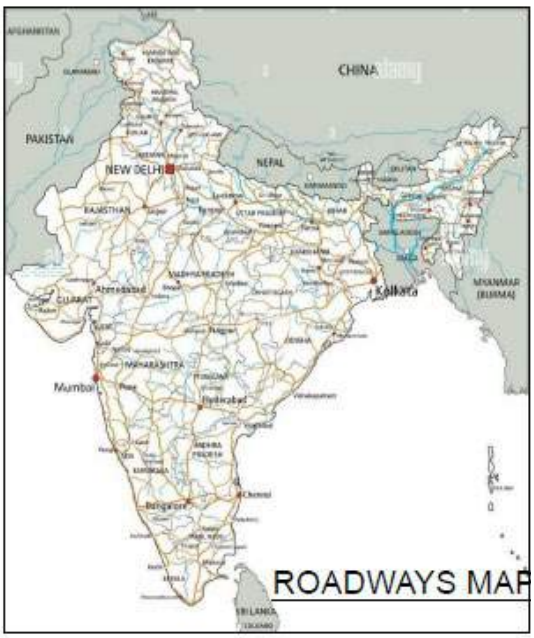
(c) **Geographical Map**. It shows the geographical features of a specific area like rivers, mountains and plains along with boundaries of states and countries.

(d) **Statistical Map**. This map shows Statistical classifications such as population and crops, in an area.

(e) **Relief Map**. This map shows the height and elevation of the land and use shading, tints, or contour lines to depict the land's physical terrain.

(f) **Rail/Road Map**. A road or railway map is a map of a rail/road network. Rail/road maps can show the relationship between train/road lines connecting various places.





DID YOU KNOW?

- The word "map" comes from the medieval Latin mappa mundi, where mappa means "napkin" or "cloth" and mundi means "of the world".
- The topographical maps are prepared by the **Survey of India** in India for the entire country.
- The science of making maps is called as **Cartography**.

(g) **Topographic map**. This map is a detailed representation of shape of land area showing natural and man - made features and other information. These are the types of map which we shall be using for map reading Topographical features and others form are explained in next chapter.

DID YOU KNOW?

- **Atlas Maps** are small scale maps showing countries, continents, oceans etc.
- **Topographical Maps** are used in Army map reading. One of the main features that sets apart topographical maps from other maps are the **Grid Lines**.
- **Longitudes and Latitudes (Lat-Long)** are shown with black coloured curved lines on the maps.

4. **Conventional Signs**. These are the symbols approved by Survey of India used to represent certain features/objects of the ground on the map. The advantage of these signs are that any person belonging to any country who speaks a different language can understand the map with the help of conventional symbols.

INTERESTING FACT

- The use of conventional signs and symbols help us to quickly get an idea of the layout and characteristics of an area just by looking at a topographical map.

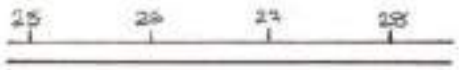
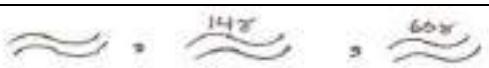
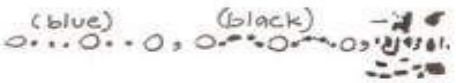
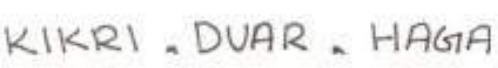
5. The Conventional Signs colour code is as follows:-

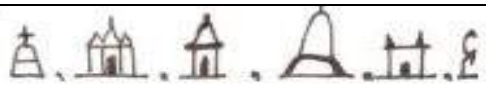
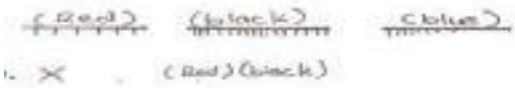
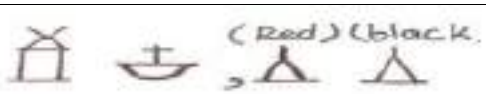
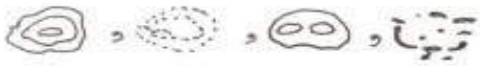
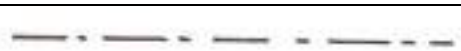
COLOUR CODES IN TOPOGRAPHICAL MAPS

Blue	Perennial water bodies
Yellow	Cultivated land
Green	Vegetation
White	Barren Lands
Brown	Contours & sand features
Black	Names, Lat. & Long, dry water bodies
Red	Human-made features

Some Conventional signs are given below.

6. Some of the important conventional signs used in topographical maps are given below:

Ser No.	Description	Nomenclature
(a)	Roads-metalled with Km-stone.	
(b)	Roads-unmetalled with Km-stone.	
(c)	Cart track, camel track, mule path.	
(d)	Foot path, road in bed of stream, Level crossing.	
(e)	Bridges with piers and without, Causeway, Ford.	
(f)	Stream-Approx water course, canal.	
(g)	Riverbanks, shelving, steep 10 to 20 feet.	
(h)	Riverbeds-dry, with stream, with island and rocks.	
(i)	Tidal river-shoal-sub merged rocks.	
(j)	Wells-lined and unlined, spring, tanks-perennial and dry.	
(k)	Kaeaz-in, flow and dry, swamp, Reeds.	
(l)	Embankments, road or rail, tank cutting tunnel.	
(m)	Broken ground, camping ground, vine on trellis.	
(n)	Spaced names, Administrative, Locality, tribal.	

Ser No.	Description	Nomenclature
(o)	Villages: open, walled, ruined, deserted antiquities.	
(p)	Huts, permanent and temporary, Fort, Tower chhatvi.	
(q)	Church, Mosque, Temple, pagoda, Eidgah, tomb.	
(r)	Dams, masonry and earth work-weir (anicut in madras).	
(s)	Lighthouse-Lightship-Buoys Bamboo-plantation.	
(t)	Grass high and low cane, Bamboo-plantation.	
(u)	Palms, Areca, palmyra, other conifer, other trees, scrub.	
(v)	Contours, Form lines, Rocky slopes.	
(w)	Cliffs-sand features.	
(x)	Moraine, Glacier, Scree.	
(y)	Boundary demarcated; international.	
(z)	Boundary demarcated, province or state.	

PART II: DIVISION OF INDIAN SUBCONTINENT INTO MAP ZONES

7. In the context of military operations, topography, or mapping, the Indian subcontinent is divided into nine grid zones to minimise errors in scale. A unique set of parameters are there for each of these zones. Map zone of Indian Subcontinent are:-

(a) Zone 0 - India and Pakistan North of 35°35'N.

(b) One IA - India and Pakistan 28°N-35°35'N.

(c) Zone IB - Unknown parts of China (Tibet).

(d) Zone IIA - India 21°N-28°N & West of 82°E and Pakistan South of 28°N.

(e) Zone IIB - Complete Bangladesh, India North of 21°N & East of 82°E and Myanmar (Burma) North of 21°N.

(f) Zone IIIA - India 15°N-21°N.

(g) Zone IIIB - Myanmar (Burma) 15°N-21°N.

(h) Zone IVA - India South of 15°N.

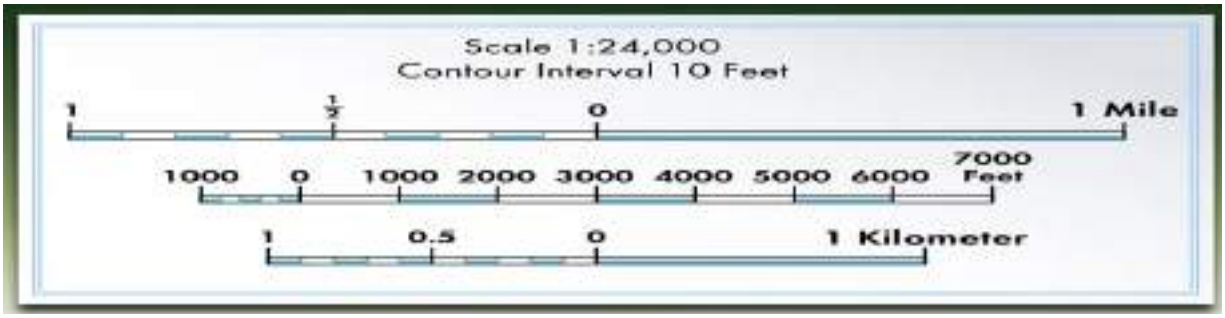
(j) Zone IVB - Myanmar (Burma) South of 15°N.

DID YOU KNOW?

- The Indian subcontinent divided into nine zones, and each zone will have its own set of grid references (e.g., 10A, 10B), making it easier to locate any specific point within that zone.

PART III: DEFINITION AND METHODS OF EXPRESSING A SCALE & SCALE LINE

8. **Definition of Scale**. Scale on the map is the ratio between the distance on a map and the corresponding distance on the ground. It's usually expressed as a fraction or ratio, such as 1:10,000 or as a bar scale. Scale is the proportion between the distance of the two points on the map to the distance between same two points on the ground. This means that the scales given on the map can help a cadet in calculating the actual distance between two points from the map itself. However, it must be kept in mind that scale is inversely proportional to details covered in the map that is to say bigger the scale lesser the details.



Types of Sclaes

9. **Methods of Expressing a Scale**. There are various methods of expressing a scale.

(a) **In Words**. This is expressed as 1" = 1 mile, it means that 1 inch on the map is equal to 1 mile on the ground.

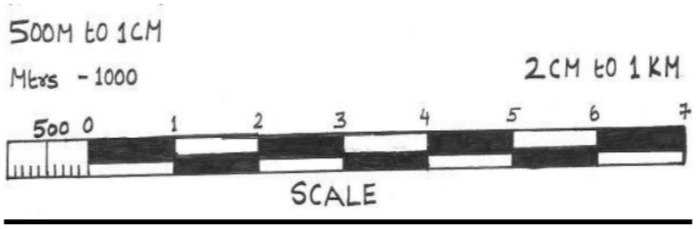
(b) **As a Representative Fraction (RF)**. In this method, scale is expressed in the form of a fraction, say 1/50,000, which means that one unit of the map represents 50,000 unit on the ground. It could mean that one centimetre on the map represents 50,000 cm (or 500 metres) on the ground. RF = Distance on map/Actual distance on ground.

(c) **Bar**. A map's scale can also be expressed graphically as a bar scale, which shows equal divisions marked with readings in miles or kilometres.

DID YOU KNOW?

- Datum followed by Survey of India is Everest Datum.
- Scale Lines on Topographical Maps are between 4 to 6 inches (10 to 15 cm) long.
- Topographical maps usually have scales ranging from 1:50,000 to 1:2,50,000.
- Area covered by 1:50,000 map sheet is 15'x 15' (15 minutes X 15 minutes), which on ground translates to 27.6 Km by 27.6 Km.
- Contour Interval on a 1: 50,000 map and 1: 25,000 map is 20 meters.

10. **Scale Line**. The large divisions of these scale lines are called primaries & small divisions on the left are secondaries. An example of the scale line for a scale "2 cm to 1 km" is as shown in below.



- Scale line lies at the centre of the bottom of the map.

PART IV: DEFINITION OF GRID AND AND METHOD OF FINDING GRID REFERENCES (GR)

11. **Grid System and Grid Lines**. A grid system is a regular pattern of horizontal and vertical purple or red colour lines intersecting each other at right angles forming squares or rectangles that would help to locate the place accurately. There are two types of grid lines- Easting grid lines and Northing grid lines.

(a) **Easting Grid lines**. These are vertical lines which increase towards the East. They are generally referred to as 'Eastings'.

(b) **Northing Grid lines**. These are horizontal lines which increase towards the North. They are generally referred to as 'Northings'.

DID YOU KNOW?

- For the ease of understanding Easting grid lines are called (*Khadi Rekha)* or vertical lines and Northing grid lines are called (*Padi Rekha)* or horizontal lines.
- Numbers of Easting and Northing grid lines will not always start with 0 or 1 in each map because starting grid lines numbers may be falling in adjacent map sheets.

12. **Method of Reading a Grid Reference**. On a 1:50,000 scale map, 2 cm are equal to 1km. Accordingly, a 4-figure grid reference (GR) on a 1:50,000 map covers an area of 1 km x 1 km, while a 6-figure GR depicts an area of 100 m x 100 m. Technically, an 8-figure GR would represent an area of 10m x 10m while a 10-figure GR would pinpoint an area of 1m x 1m, however both these GRs are difficult to be plotted on a 1;50,00 Map, hence Map Reading is restricted to using six figure GR only.

13. **The steps to read a GR of any point are as follows**.

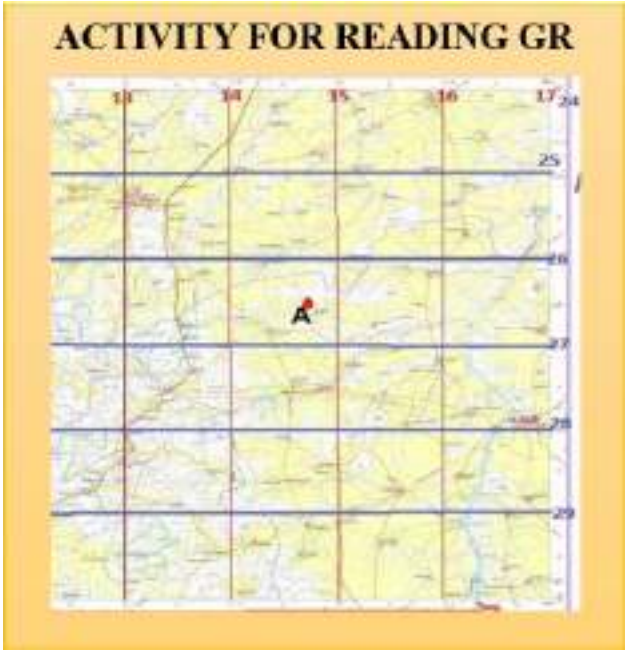
(a) A reference is always in even number of figures and start reading from south west corner.

(b) Grid References are of different types viz. 4- Figure, 6-Figure, 8- figure and 10- Figure.

(c) Mostly 6- Figure Grid Reference is used.

(d) For 4-figure GR of any point A in given activity, first read EASTING lines number from the WEST to EAST and then read NORTHING lines number from SOUTH to NORTH. Thus, 4-fig GR is1427.

(e) For 6-fig GR of point 'A', take nearest 10th part of sub-division of easting line number as 3rd digit and nearest 10th part of sub-division of northing line number as 6th digit. Thus, 6-fig GR is 147275.



(f) For six figure Grid Reference the third and the Sixth figure represent the divisions of 1000 meters square to the nearest 10th part, so they have to be estimated and for these figures a slight latitude is allowed.

(g) If a general Grid Reference is to be given or there is only one such object in one square e.g. bridge, temple, road junction then its identity and four figure grid reference would suffice.

HOT

Correlation Between Lat-Long Maps and Metric Maps. For the purpose of Map projection, Indian and adjacent countries encompassing areas from 4º N to 44º N Latitude and 44º E to 124º E Longitude have been covered as under:-

- **Grids of 4º by 4º**. Total area was divided into grids of 4º by 4º, which came to 180 such grids. Since 44 of these were in waterborne areas, balance 136 were projected on Map sheets with scale of 1:10,00,000(called Million Maps) or 1" : 16 Miles, each comprising an area of 441.6 Km by 441.6 km.

- **Grids of 1º by 1º**. Each grid of 4º by 4º was further sub-divided into 16 grids of 1º by 1º with scale of 1: 2,50,000(called Degree or Quarter Inch Maps) or 1": 4 Miles, each comprising an area of 110.4 Km by 110.4 Km. These were numbered from A to P. A total of 2176 (136x16)sheets were required to be made.

- **Grids of ½ º by ½º**. Further four sub-divisions of ½ º by ½ º or 30' by 30 'were made of each 1º by 1º sheet on a scale of 1:1,00,000(called Half Inch Maps) or 1"= 2 Miles, titled NE,NW,SE or SW, with each such grid depicting an area of 55.2 km by 55.2 Km. A total of 8704(136x16x4) such sheets were made.

- **Grids of 15' by 15'**. Further four sub subdivisions of each ½ º by ½ º Sheets were done. Since this also meant 16 sub divisions of the 1º by 1º grid, these were numbered as 1 to 16. The scale of these Maps was 1:50,000(called Inch Maps) or 1" = 1 Mile, each comprising an area of 27.6 Km by 27.6 Km. A total of 34816(136x16x4x4) such sheets of 15' by 15' were made. This is the sheet which is typically used for MR in NCC.

DID YOU KNOW?

- While reading a GR in topographical maps, Eastings are read first followed by the Northings, but for reading co-ordinates from Latitude- Longitude Maps, the latitudes (horizontal lines) are read first and then the longitude. For example, the location of India Gate in Delhi is given as 28.6129° N, 77.2295° E.

CONCLUSION

14. The proper knowledge of the map and its conventional signs is very essential to know about the unknown area and to relate the objects on ground with the objects on the map by their conventional signs. Conventional symbols help in detailed study of a map. It is important for everyone to relate conventional signs accurately for reading a map efficiently. The grid system and reading grid reference help in locating the different objects of ground on map within a span of 10 to 100 meters. Moreover, it enables us to find our own position and plays a fundamental role in navigation.

SUMMARY

- Map is a piece of paper on which objects on the ground are shown with the help of some conventional signs on a particular scale.
- Scale is a ratio of distance between any two objects on the map with respect of the actual distance on ground.
- Scale can be expressed In Words and as a Representative Fraction (RF).
- A grid system is a regular pattern of purple or red colour lines intersecting each other at right angles forming squares or rectangles that would help to locate the place accurately.
- Easting Grid lines are the vertical lines whose number increases towards east.
- Northing grid lines are the horizontal lines whose number increases towards north.
- There are different types of Grid reference- 4 figure, 6- figure, 8- fig and 10 fig depends upon requirement of accuracy in finding location in a range of area 10 m to 1000m.
- For reading GR of any location, first Eastings are read followed by Northings.

ASSESSMENT EXERCISE

Multiple choice questions

Q1. Map that represents boundaries of state & countries is?

(a) Political maps
(b) Statistical maps
(c) Geographical maps
(d) Relief maps

Q2. The map which shows the rock formation below the topsoil?

(a) Statistical maps (b) Geographical maps
(c) Topographical maps (d) Meteorological maps

Q3. Which of the following are small scale maps showing whole countries continents oceans or even world on one sheet?

(a) Atlas maps (c) Relief maps
(b) Rail/road maps (d) Geographical maps

Q4. The maps show the information about population, industries, minerals ores etc are?

(a) Meteorological maps
(b) Relief maps
(c) Topographic maps
(d) Statistical maps

Q5. Which colour is used to show river on a map?

(a) Yellow (b) Blue (c) Black (d) Red

Q6. The science of making maps is known as?

(a) Photography (c) Choreography
(b) Cartography (d) None of the above

Q7. Which maps are an actual model of the ground?

(a) Relief maps
(b) Rail/Road maps
(c) Statistical maps
(d) None of the above

Q8. The maps that are used in connection of roads

(a) Statistical maps
(b) Rail/Road maps
(c) Relief maps
(d) None of the above

Q9. What is the conventional sign of Broken ground, camping ground, vine on trellis?

(a) 
(b) 
(c) 
(d) 

Q10. The conventional sign of Riverbeds-dry, with stream, with island and rocks

(a) 
(b) 
(c) 
(d) 

Q11. Which map we use to study in NCC?

(a) Relief Map (c) Statistical map
(b) Topographical map (d) Atlas map

Q12. There are _____ types of grid lines.

(a) 3 (b) 5 (c) 2 (d) 4

Q13. What are Easting Grid lines?

(a) Black vertical line (c) Red vertical line
(b) Black horizontal line (d) Red horizontal line

Q14. Which colour is used to show sand features on map?

(a) Red (b) Blue (c) brown (d) Yellow

Q15. What is scale of 1:50000 means?

(a) 1 cm= 1km (b) 2cm= 1km (c) 1cm= 2km (d) 1cm=50km

Short Answer Type Questions

Q1. What do you understand by map? Mention Its types?

Q2. What are Grid Lines?

Q3. What is Scale? What is Scale Line?

Q4. What is RF?

Q5. What are limitations of Map?

Long Answer Type Questions

Q1. Define Conventional signs? Draw conventional signs for battlefield, Fort, Graveyard and Railway line?

Q2. Explain method or rules for calculating Grid Reference?

Q3. Explain Grid System. What are types of Grid lines?

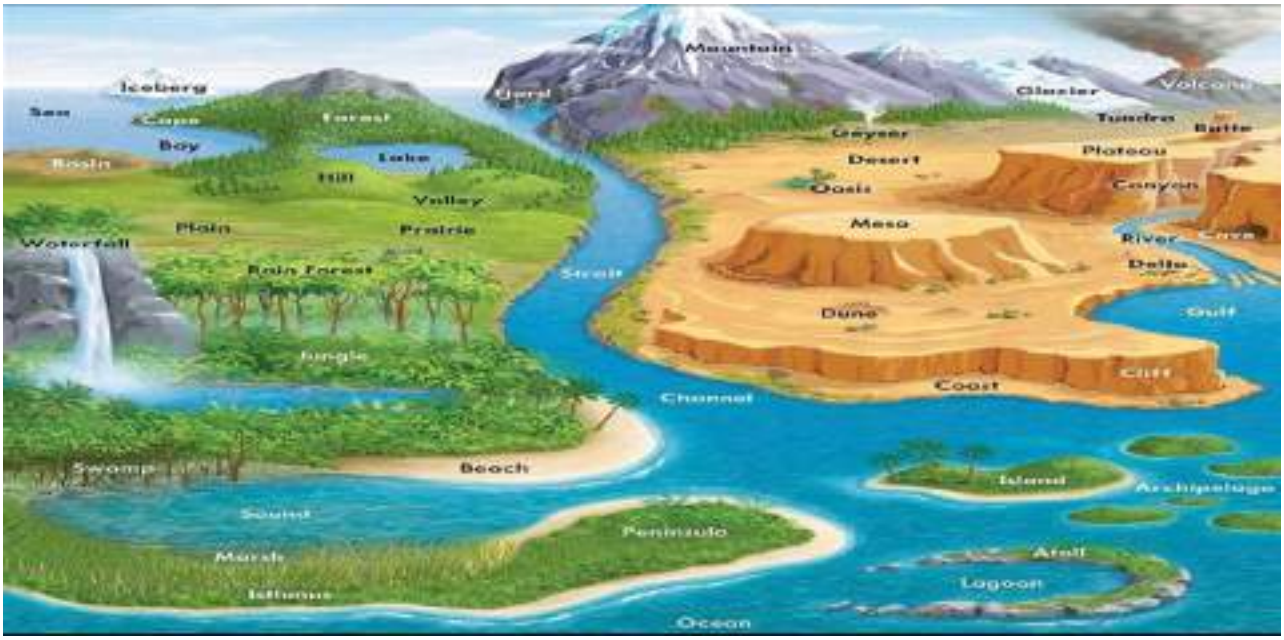
Q4. Calculate RF of 1: 250000.

Q5. What are colour code of conventional signs for different features?

MAP READING

CHAPTER MR-II: TOPOGRAPHICAL FORMS AND TECHNICAL TERMS

A map says to you, read me carefully, follow me closely, Doubt me not... I am the earth in the palm of your hand. Beryl Markham



TEACHING INSTRUCTIONS

Period	**:**	**03 (120 Mins)**
Type	**:**	**Lecture and Practice.**
Year	**:**	**1st (01) and 2nd Year (02) SD/SW**
Conducting Officer	**:**	**Permanent Instructor.**

Training Aids: Map, Compass and Pencil.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 35 Mins**
- **Part II : 35 Mins**
- **Part III : 40 Mins**
- **Conclusion : 05 Mins**

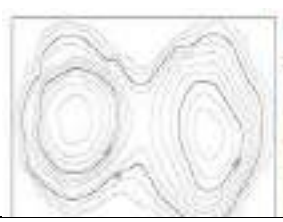
INTRODUCTION

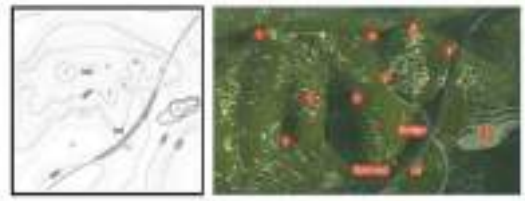
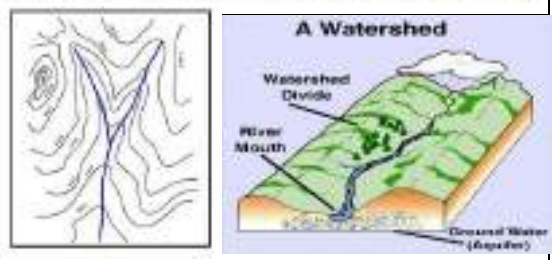
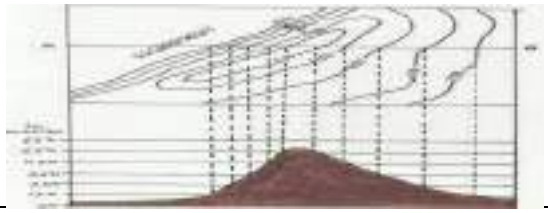
1. Topography is the study of natural and man-made features on ground. The topography of an area is description of the land forms and features on map of that area. The different types of structures, terrains and groups of shapes on surface of earth are termed as Topographical forms. In India, the topographical maps are prepared by Survey of India. Topographical maps are of different scales. As these maps are prepared by the same agency in India, for the ease of identification and assimilation, these maps have same conventional signs, symbols and colours for same physical features.

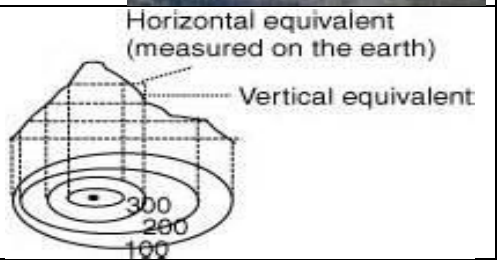
PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Topographical forms and their technical terms.** ➢ **Part II: Relief, contours, gradient, horizontal equivalent and vertical interval.** ➢ **Part III: Practice of reading gradient and contours.**	➢ **Understanding various topographical forms and their technical terms**. ➢ **To comprehend the Relief and its methods of representation**. ➢ **To acquaint with contour, gradient, horizontal, equivalent and vertical interval**.

PART I: TOPOGRAPHICAL FORMS AND THEIR TECHNICAL TERMS

2. The topographical forms are the physical features present on the earth. For instance, mountains, plateaus, rivers, lakes and plains are some of the major topographical forms of the earth. Some important topographical forms with their description and their respective ground and map view are given in the table below:-

Ser No	Topographical Forms	Map View	Ground View
(a)	**Basin**. The area which is fairly levelled either by the depression on hills or drained by a river and its distributaries is called Basin.		
(b)	**Col or saddle**. Two higher hills when joins form a narrow ridge of high land called Col or Saddle.		

(c)	**Crest**. The highest part of a mountain range or hill is joined by an imaginary line. The ground slopes down in opposite direction from this line.	
(d)	**Knoll**. A small isolated hill is called Knoll.	
(e)	**Plateau**. A plateau is an elevated tabled land and almost flat surface formed on top of a hill.	
(f)	**Ridge**. It refers to a long, narrow elevated area or crest of land, typically formed by the natural erosion of the landscape. Ridges are often the top parts of mountain ranges or hills and can be visualized as the "spines" of a range of mountains.	
(g)	**Spur**. The piece of high ground descending from range of hills into lower ground is called Spur.	
(h)	**Watershed**. The high part of a mountain range which separates the water flow of two different rivers is called a watershed. It is not necessary to be the highest part of a mountain or mountain range for the watershed.	
(i)	**Defile**. The narrow feature for which the troop has to reduce its front/ formation to cross is called Defile. Bridge is an artificial defile.	
(j)	**Escarpment**. The steep slope formed by a sudden drop in hill side separating comparatively two level or more gently sloping surface resulting from erosion is called Escarpment. It is usually from a plateau.	

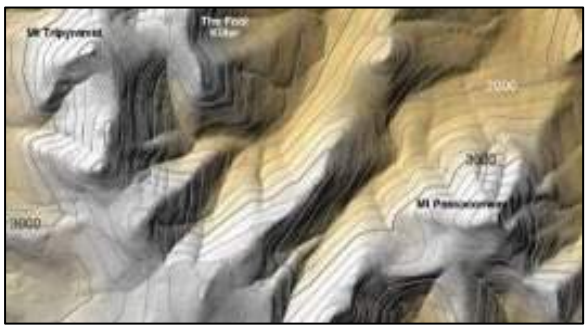
(k)	**Bench Mark**. Is a permanent mark usually cut into a wall recording exact height for future reference. On Ordnance Survey Maps it is marked as BM with height on it.	
(l)	**Spot Height**. The height of some points is determined by Survey methods and mentioned with black dot and a number giving exact height above sea level in meters.	
(m)	**Trig Height**. A point marked by a small triangle with the height on Ordinance Survey Maps. It is fixed during the triangulation at the beginning of a survey.	
(n)	**Horizontal Equivalent**. The distance measured between adjacent contour lines which varies according to the nature of the relief.	

DID YOU KNOW?

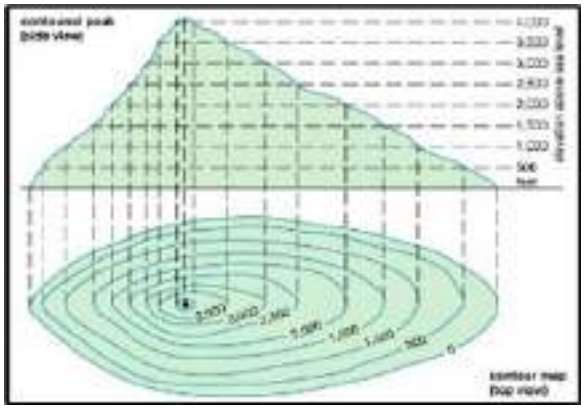
- Spot height and Trig height of a place are generally not the same.

PART II: RELIEF, CONTOUR, GRADIENT, HORIZONTAL EQUIVALENT AND VERTICAL INTERVAL

3. **Relief**. It is undulating feature of the land that shows heights and shape of the ground above or below sea level. The relative heights of highlands and low lands is shown by **Relief** which is depicted by shading, form lines, hachure, contours, spot heights, layer tints, bench marks, trig heights and relative heights on a map.



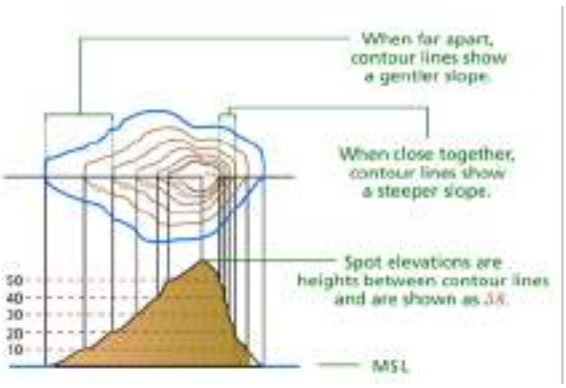
4. **Determining Relief of a map**. It is very simple to determine the relief of a map. The difference in elevation between the highest and lowest points in an area is calculated as Relief. For example, if a mountain has an elevation of 5,000 feet and an adjacent valley has an elevation of 1,000 feet. The relief between these two is calculated by subtracting the lowest elevation from the highest and we find that the relief between the two is 4,000 feet.

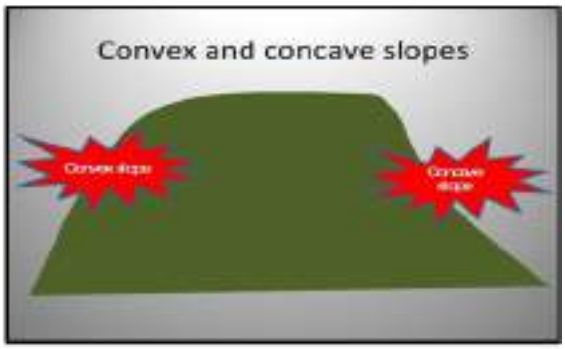


5. **Contours**. These are lines that joins all the points of the same height above sea level on a map. A person doesn't gains or loses elevation while walking along a contour line. The characteristics of Contours are as following:-

(a) They precisely depict height, shape, and slope of a place.
(b) In general, contours are represented in brown colour.
(c) Every fifth contour is known as the Index Contour as height is marked on it.
(d) The shapes made by contour lines differs.
(e) Contour lines never meet or cross each other.
(f) Distance between two contour lines is 20 meters.

6. **Slope**. It means a rise or fall of the Earth's surface. Slope generally follows the grain of the country starting from a higher point and moving towards a lower point. These slopes can be gradual as well as steep. When distance is less and contour lines are closer than the slope of the hill is steep. If contour lines are far apart, then slope down is gradual. The slopes are of two types:-



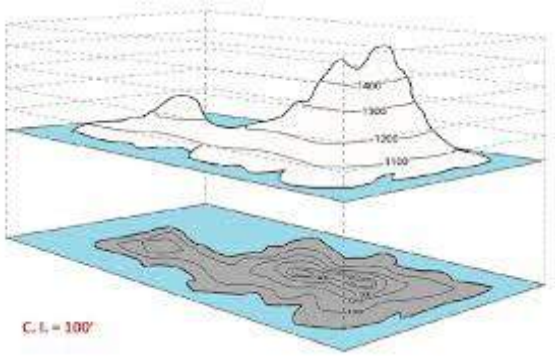


(a) **Regular slope**. The slopes with equal rise and fall are called regular slopes. They are also refer to as gentle slopes.

(b) **Irregular slope**. The slopes with unequal rise and fall of earth are called Irregular slopes. There are two types of irregular slopes: convex and concave slopes.

A convex slope is one where from the top, its bottom cannot be seen as the slope bulges outwards and obstructs the view. The concave slope is one in which the slope curves inward and the view to the bottom is clear.

7. **Gradient**. It is the slope of a hill or height, which is expressed as a fraction. The ratio between vertical interval and horizontal equivalent are expressed as a fraction VI/HE. The vertical interval is taken as numerator and the horizontal distance is taken as the denominator. In this the vertical interval is equal to the vertical distance between two successive contours whereas the horizontal equivalent is the horizontal distance between the same adjacent contours.



The formula for Gradient = (Vertical interval)/(Horizontal distance).

Gradient = slope in degree/60

Calculating Gradient

If the lowest contour is 200 and highest contour is 500. The Vertical Interval is 300m. the Length from point A to B is 6 cm. Map Scale is 1cm to 2km Calculate the gradient.

Solution

- Change 6cm into ground (map scale 1cm to 2km)
- 6cm = 6 x 2 km = 12km
- 12km =12000m (1km =1000m)
- Gradient = (Vertical interval (V.I))/(Horizontal distance (H.D))
- =300m/12000m
- Gradient = 1/40

8. **Expressing Gradient**. The gradient can be expressed as ratio and percentage as given below:-

(a) **As a Ratio**. Example: If the rise is 100 meters and the run is 500 meters, the gradient is 1:5. This means for every 5 units of horizontal distance, there is a 1-unit rise.

(b) **As a Percentage**. Convert the ratio into a percentage by multiplying by 100: Gradient Percentage= (Vertical Distance/Horizontal Distance) × 100

Example: (100/500) ×100=20%

PART III: PRACTICE OF READING GRADIENTS AND CONTOURS

9. **Basic Gradient Calculation**. Learn to calculate the gradient between two points on a map.

Steps

(a) Two points were chosen on the topographic map with clear contour lines.

(b) Measure the vertical elevation change between the points using the contour interval (e.g. Point A = 200m, Point B = 300m; elevation change = 100m).

(c) Measure the horizontal distance between the points using the map scale.

(d) Calculate the gradient using the formula: Gradient = Vertical Distance / Horizontal Distance.

(e) Example: If the vertical distance is 100m and the horizontal distance is 500m, the gradient is 100/500=1/5=1:5

10. **Comparing Gradients**. Identify and compare gradients of different slopes.

Steps

(a) Select three different slopes on the map (e.g. hill, valley and ridge).

(b) Calculate the gradient for each slope using the method above.

(c) Compare which slope is steeper by analysing the gradient ratio (smaller ratios indicate steeper slopes).

11. **Identifying Steep and Gentle Slopes**. Visually interpret gradient steepness without calculation.

Steps

(a) Examine contour spacing on the map:

(i) Closely spaced contours indicate steep slopes.

(ii) Widely spaced contours indicate gentle slopes.

(b) Mark areas of steep and gentle slopes on the map.

(c) Validate your assessment by calculating gradients in selected areas.

12. **Gradient Application in Planning**. Use gradient calculations for route selection.

Steps

(a) Plan a hiking or cycling route using a topographic map.

(b) Identify areas with steep gradients to avoid or challenge.

(c) Calculate gradients along different paths to decide the most suitable route based on difficulty.

13. **Practical Benefits**. These exercises not only improve your understanding of gradients but also enhance skills in terrain analysis, route planning and decision-making in activities like hiking, surveying and environmental assessment.

CONCLUSION

14. It is essential to understand various aspects of topographical forms and their technical terms in detail for a successful map reading during military operations. By knowing relief, contour and gradient etc, as discussed in this chapter we will be able to understand the terrain layout, difficulty in traversing the terrain, calculate approximate time to navigate through that particular terrain and special stores that are required to carry to cross difficult objects during the navigation. Relief map over a topographic map will be of great help to understand the terrain as it shows the terrain in a 3D view. To achieve expertise in map reading such as contour lines reading and understand the layout of the terrain more practical knowledge is imperative.

SUMMARY

- Topographical forms are fundamental for understanding and interacting with the physical environment.
- They bridge the gap between theoretical map reading and real-world geography, enabling users to analyse, interpret and adapt to diverse terrains effectively.
- Mastery of topographical knowledge is essential for professionals and enthusiasts in various fields, fostering informed decision-making and a deeper appreciation of the Earth's landscape.
- Relief is undulating feature of the land that shows heights and shape of the ground above or below sea level.
- **Relief** is shown with means of, shading, form lines, hachure, contours, spot heights, layer tints, bench marks, trig heights and relative heights.
- Contour is an imaginary line that joins all the points of the same height above sea level.
- **Slope** means a rise or fall of the Earth surface.
- The slopes with equal rise and fall of earth are called **Regular slopes**.
- The slopes with unequal rise and fall of earth are called **Irregular slopes**. There are two types of irregular slopes: convex and concave slopes.
- Gradient is the slope of a hill, which is expressed as a fraction. The ratio between vertical interval and horizontal equivalent are expressed as a fraction VI/HE.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. _____ is the study of the forms and features of land surfaces.

(a) Topography (b) Geography
(c) Polygraphy (c) Radiography

Q2. A small isolated hill is _____.

(a) Mountain (b) High Ground
(c) Knoll (d) Saddle

Q3. Gradient is the slope of a hill and it is expressed as a _____.

(a) Number (b) Fraction
(c) Bearing (d) Degree

Q4. The angle formed by a line joining two points and the North and South line is called _____.

(a) Degree (b) North line
(c) Bearing (d) Contour

Q5. Bearings are always measured in which direction?

(a) Clockwise (b) Anti Clockwise
(c) Top to Bottom (d) North to South

Q6. _____are the lines drawn on topographical maps to join all places or areas with the equal height or altitude from the mean sea level.

(a) Northings (b) Eastings
(c) Relief (d) Contours

Q7. _____is the difference in height between the two places.

(a) Trigonometric Height (b) Vertical Interval (V.I)
(c) Horizontal Distance (d) Spot

Q8. True North is the direction of the _____Pole from the point.

(a) North (b) South
(c) Eash (d) West

Q9. A ‘V’ shape contour lines indicate a much _____ ridge.

(a) Gentle slope (b) Plain
(c) Steeper (d) River

Q10. The difference between True North & Magnetic North is called _____.

(a) Vertical Interval (b) Horizontal distance
(c) Magnetic Variation (d) Grid Variation

Q11. What is a Trigonometric Point on a map?

(a) A point that indicates the elevation of a place
(b) A point marked by a small triangle used during triangulation
(c) A point representing the highest point on a map
(d) A point indicating the location of a mountain range

Q12. What is the purpose of contours on a map?

(a) To join points of equal temperature
(b) To join points of equal height above sea level
(c) To indicate the distance between two points
(d) To mark boundaries of different countries

Q13. What does the Horizontal Equivalent represent in relation to contour lines?

(a) The distance measured between adjacent contour lines
(b) The total area covered by a map
(c) The average height between contour lines
(d) The total elevation of a region

Q14. Relief on a map refers to:

(a) The representation of vegetation types
(b) The depiction of elevation differences and shapes of landforms
(c) The boundaries of urban areas
(d) The distance between various landmarks

Q15. How is relief calculated on a map?

(a) By measuring the height of mountains
(b) By subtracting the lowest elevation from the highest elevation in an area
(c) By calculating the slope of a hill
(d) By adding all elevations in a region

Short Answer Questions

Q1. What are contours?

Q2. What is topography?

Q3. What is gradient?

Q4. What is the characteristic of contour lines on a map?

Q5. What does a regular slope indicate?

Long Answer Questions

Q1. Write any five topographical forms.

Q2. Write any three Technical Terms of Topography.

Q3. What are Trigonometric height and Spot? Explain with diagrams.

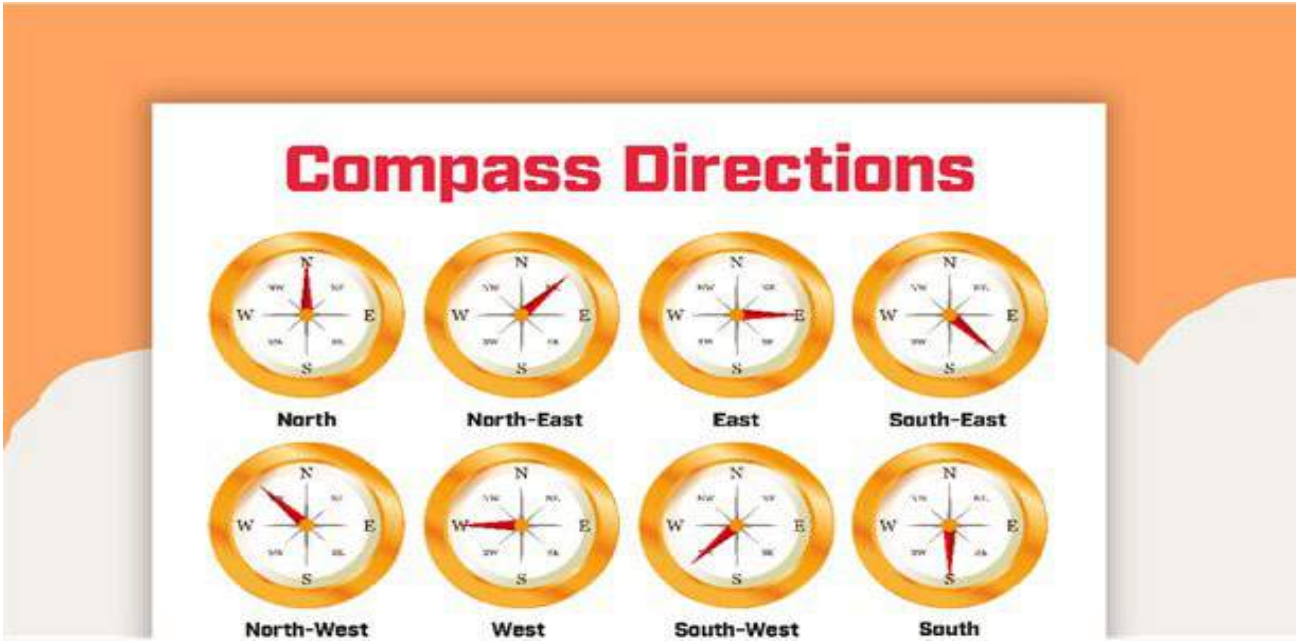
Q4. How is relief calculated on a map?

Q5. What are characteristic of a convex and concave slope?

MAP READING

CHAPTER MR-III: CARDINAL POINTS AND TYPES OF NORTH

"Mastering navigation starts with knowing cardinal directions and north types."



TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**PI Staff**

Training Aids: Class Room, Prismatic compass, Map, Screen, Pointer Staff, Presentation, Precis Flagged or Lesson Plan in File, Board, Markers, Graph Pencils, Display Charts.

Time Plan

- **Introduction : 02 Mins**
- **Part I : 08 Mins**
- **Part II : 05 Mins**
- **Part III : 10 Mins**
- **Part IV : 10 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. Knowing the directions is essential for every person to reach at respective destination. However, for Military purpose or for NCC cadets, it is the first step towards Map Reading. From the point of view of military action, the north direction is considered to be the most important of the four major directions. It is very important to find the directions on the ground and map. It is difficult to make and understand a map or a sketch without knowing the north direction. In the same way, on the ground, we also need to know the directions to march under different conditions. There are many good methods to find the north direction, in which the methods of finding the north direction are different during the night and day. Thus, when the north direction is known, we can find the remaining direction.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Cardinal directions.** ➢ **Part II: Types of North.** ➢ **Part III: Variation Between North Lines.** ➢ **Part IV: Methods used for find out North.**	➢ **Understanding Cardinal Directions.** ➢ **Understanding types of north to learn the various types of north.** ➢ **To comprehend Magnetic variation, Grid Convergence.** ➢ **To Understand methods to find north with or without compass.**

PART I: CARDINAL DIRECTIONS

2. **Kinds Of Directions**. For learning, we can divide the directions into three parts:-

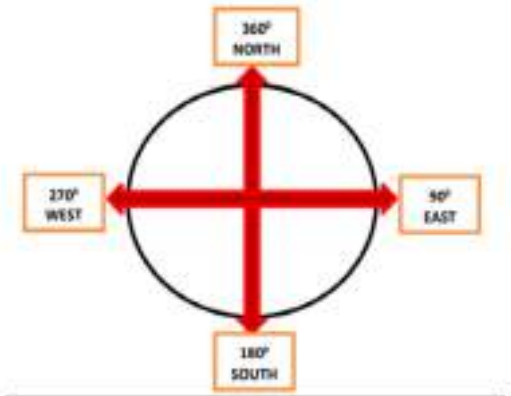
(a) Major directions or Cardinal directions:-

(b) Intermediate directions

(c) Minor directions (sub-intermediate direction)

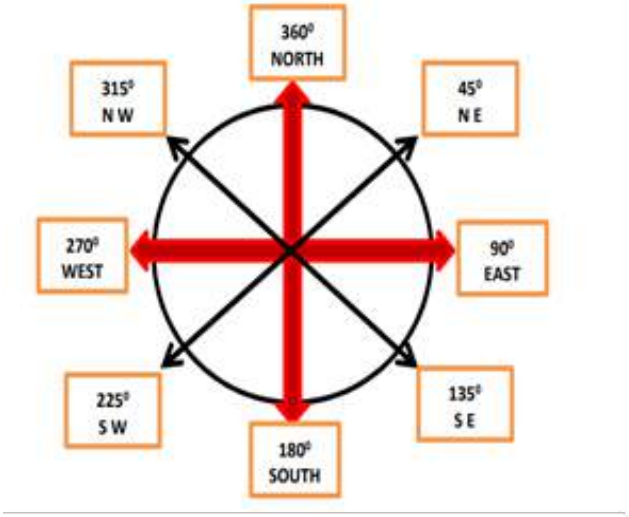
3. For the ease of understanding and assimilation, the explanation of cardinal, intermediate and minor directions with diagrams ia as given below:-

(a) **Cardinal Directions**. There are four main Cardinal directions which are North, South, East and West. The north direction is considered to be 360° because the bearings start from the north direction to measure the curve in the degrees. It takes 360° in turning from north to north. In this rotation, the east direction is at 90°, the south direction is at 180° and the west direction is at 270°.

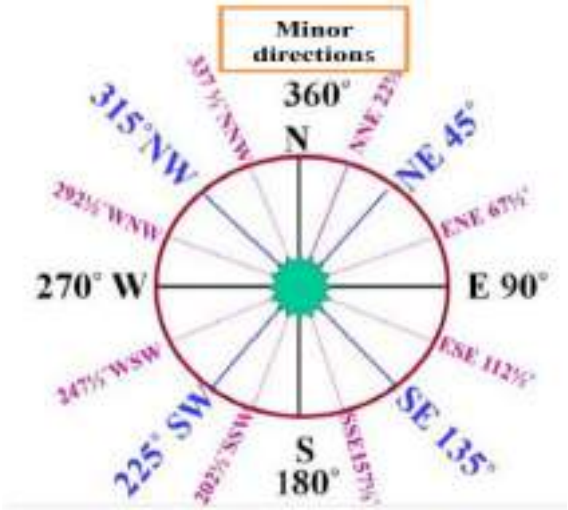


Cardinal Directions

(b) **Intermediate Directions**. The intermediate directions are also four (04). These directions fall between the cardinal direction, i.e. each cardinal direction is divided into two equal parts. These are named as North East (NE), South East (SE), South West (SW) and North West (NW).



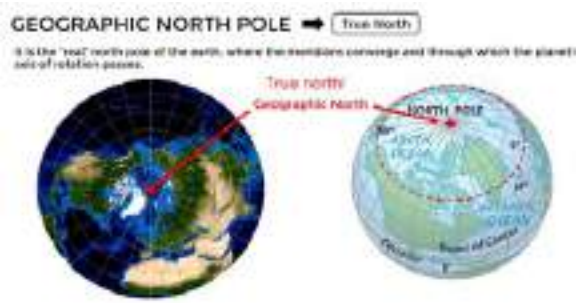
(c) **Sub-Intermediate Directions (Minor directions)**. There are eight (08) sub-intermediate directions between cardinal and intermediate directions, which are represented by three letters. Their names are given in such a way that the cardinal direction is named first and then the intermediate direction. Thus, a sub-intermediate direction is half of the angular distance between a cardinal direction and an intermediate direction, i.e., 22 and 1/2 degrees.



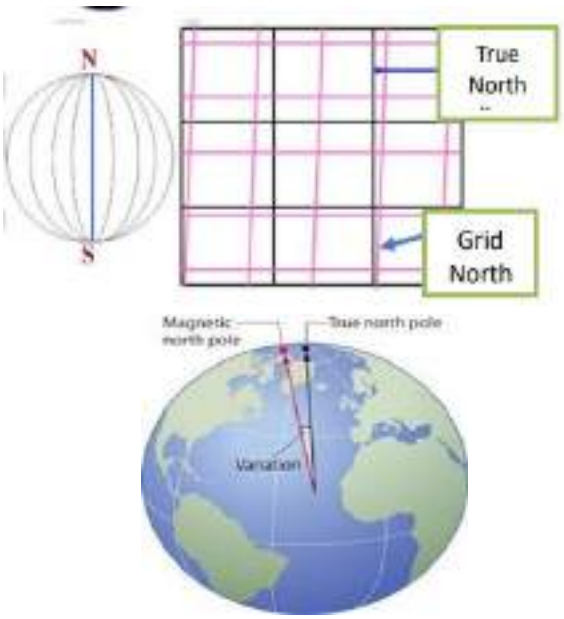
PART II: TYPES OF NORTH AND BEARINGS

4. **Types of North**. On ground, there is only one North, that is the True North. However, since there are no tools to depict it directly, same is done with the help of Grid North and Magnetic North. These three norths are explained below:-

(a) **True North**. It is the direction of the geographic North Pole of the Earth at 90-degree North Latitude. This is a fixed point on the Earth's surface and it doesn't change. On a map, True North is depicted by a solid black North-South line.



(b) **Grid North**. Grid North is the North depicted by the North-South lines of a map (grid). Since semi-circular lines of longitudes are depicted as straight lines on maps, an angular difference is created which makes them deviate from True North. The direction of Grid North is hence marked separately and depicted by red or purple lines on a map, called grid lines.



(c) **Magnetic North**. It refers to the direction to the Magnetic North Pole, as indicated by the north-seeking needle of a magnetic compass. The position of Magnetic North is not static as the magnetic field of the Earth keeps varying, so it does not align with True North. For this reason, it is also not depicted on a map.

5. **Bearing**. The angle formed between an object and North, with respect to a particular location or observer, is known as Bearing. It is always measured clockwise and is related to one of the three types of North. It is classified on two basis:-

(a) On the basis of North.

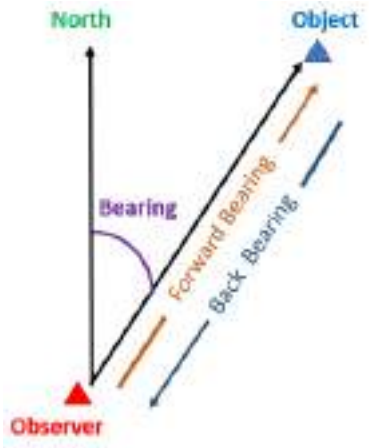
(b) On the basis of orientation (forward or back).

6. **Types of Bearing on Basis of North**. These are:-

(a) **True Bearing**. The clockwise angle formed between an imaginary line joining two points and the direction line of True North is called True Bearing.

(b) **Magnetic Bearing**. The clockwise angle formed between an imaginary line joining two points and the direction line of Magnetic North is called Magnetic Bearing.

(c) **Grid Bearing**. The clockwise angle formed between an imaginary line joining two objects and the direction line of Grid North is called Grid Bearing.



7. **Types of Bearing on Basis of Orientation**.

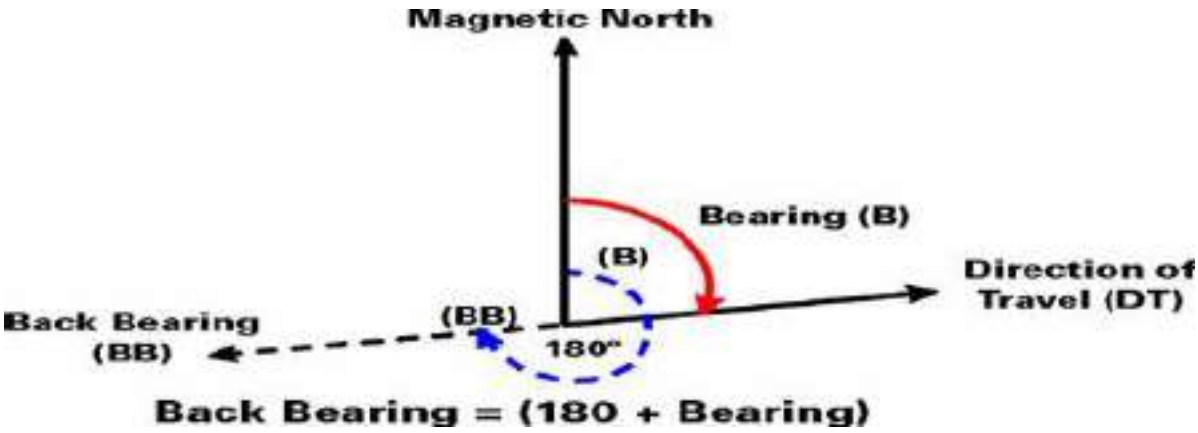
(a) **Forward Bearing**. The bearing of an object's position from the observer.

(b) **Backward Bearing**. It is the reverse of forward bearing and means the bearing of the observer from the object. It is obtained by adding or subtracting 180 degrees to/from the forward bearing.

8. **<u>Relationship Between Forward Bearing And Back Bearing</u>**. The Back Bearing of a line can be determined if its Forward Bearing is given and vice versa. If the Forward Bearing of a line is given as the whole circle bearing, then following is the way to calculate back bearing:-

- Back Bearing = Forward bearing + 180, if F.B. <180° and,
- Back Bearing = Forward bearing – 180, if F.B. > 180°.
- B.B. = F.B ± 180°

Let us understand the same with the help of below diagram.



Examples: Forward bearing of a tree and temple are measured 60° and 270° respectively. Find out their back bearing.

- Forward bearing of tree = 60°
- Back bearing of tree = 60° + 180° = 240°
- Forward bearing of temple = 270°
- Back bearing of temple = 270° - 180° = 90°

9. **<u>Reasons for Non-Alignment among Types of North</u>**. The earth spins on its axis, which passes through the North and South poles. **The North Pole with its Latitude as 90 Degrees North is the geographical or True North and is located in the middle of Arctic Ocean**. Since all Longitudes converge at this point, it does not have its own Longitude. The True North direction is fixed in space and time, i.e. it neither varies from place to place nor from time to time. Depiction of True North on a Map is done by black coloured 'Meridians', which are lines drawn from North Pole to South Pole and are true North-South lines.

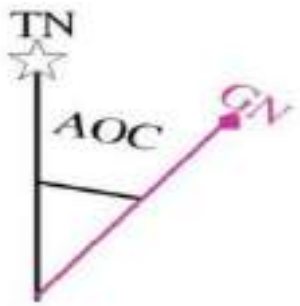
10. Grid lines, marked on the map for referencing, do not lie in the true North and South direction except along one standard meridian (00) and elsewhere they make an angle with the true North-South line. Since all grid lines marked on the map are parallel, they are conveniently used for drawing or measuring bearings. **The northern alignment of the North-South grid lines is hence recognized as Grid North**. On the map, they are shown in purple colour. Grid North and Grid Lines are also fixed in space as well as time i.e. their relative position with reference to True North and True North-South lines remains the same at a given place.

11. Magnetic North is the direction towards the Magnetic North Pole, which is a wandering point where the Earth's magnetic field goes vertically down into the planet. It is estimated

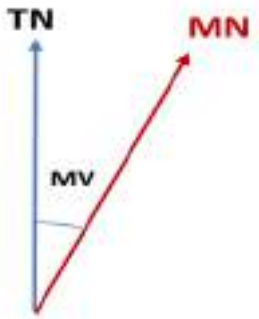
that it is moving at a speed of about 40 kilometres per year and over the last century the Magnetic Pole has moved a remarkable 1100 kilometres. **The present location of Magnetic North Pole (in 2025) is 85.7 N and 138.6 E, about 1200 km south of the True North or the geographic North Pole and falls in Canadian Territorial waters, west of Greenland**. The needle of a Magnetic Compass points to this location and not to the True North. There are only a few places at which Magnetic North coincides with the True North. At other places it is at an angle to True North which varies yearly. Therefore, Magnetic North lines are not shown on topographical map

PART III: VARIATION BETWEEN TRUE, GRID AND MAGNETIC NORTH

12. **Variation Between True, Grid and Magnetic North**.
These are as follows:-



(a) **Angle of Convergence (Grid Convergence)**.
The angular difference between True North and the Grid North line at a given place is called the angle of convergence. Grid convergence remains constant and does not change for a given location. In topographical maps, it is generally specified on top of the map.



(b) **Magnetic Variation**. The angular difference between True North and Magnetic North is called Magnetic Variation. Magnetic variation varies not only between different countries but also within different regions of a single country. It changes gradually over time each year. Where the difference is negligible, it is treated as constant. The magnetic variation for the map's publication year is shown at the top and to update it, one can adjust the value annually based on the number of years since the map was published.

Example:

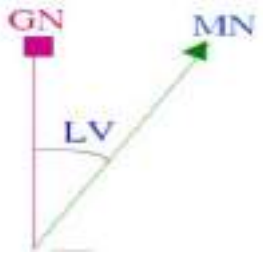
For a given location, Magnetic Variation was 2° East in the year 1968, decreasing every year by 2'. What will be the magnetic variation in the year 1998?

Ans. Total years 1998 – 1968 = 30 years

Decrease in 30 years 30 x 2 = 60 minutes or 1°

Therefore, MV during 1998 will be 2°-1° = 1° East.

(c) **Local Variation /Grid Magnetic Angle (GMA)**.
Due to the difference between the Grid North and the Magnetic North line at a given place, the angular distance between them is called Local Variation. It is related to the indicated Magnetic North, which can be in either east or west direction, but the angle of convergence will always remain the same.

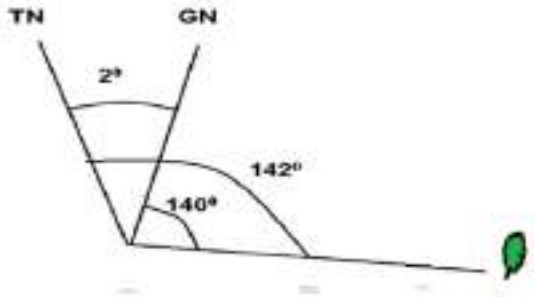


Local Variation

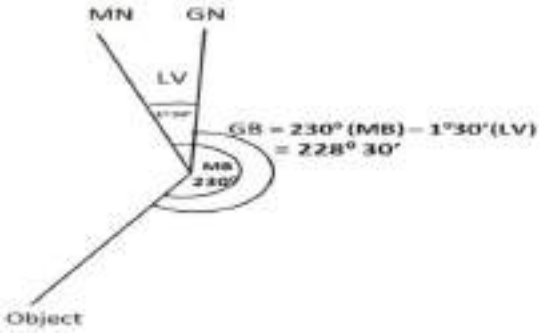
13. **Conversion of bearing**. Conversion of bearing is required for finding own position and to remove compass error. Examples of Conversion are given below:-

Examples of Conversion

(a) **Grid bearing into true bearing**. A tree has a grid bearing of 140° from a point 'A'. If angle of convergence (GV) is 2° east, then what is true bearing.
Solution: The angle of convergence is 2° east i.e. true bearing is 2° more than grid bearing. True bearing of tree from point 'A'= 140°+ 2° = 142°.



(b) **Magnetic bearing into grid bearing**. The magnetic bearing of an object is 230°. is Grid bearing of that object, if magnetic north is in west of grid north and local variance is 1°30' west?
Solution: the local variance i.e. MN is in 1°30' west of GN. Grid bearing of the object is 1°30' less than magnetic bearing. GB= 230°-1°30' = 228°30'.



(c) **Magnetic bearing into true bearing**. The magnetic bearing of an object is 165°. What is true bearing of the object, if the magnetic variance is 48' west?
Solution: Magnetic north is in 48' west of True north i.e. True bearing is less than 48' than MB. True bearing of the object = 165°-48' = 164°12'.

HOTS

- Considering different methods to find north, which method would you recommend for a person in a dense forest without any modern tools? Justify your choice.
- During the day, if you are stranded without a compass and a map, explain how you can use the "Sun Dial" method to determine the north direction. What potential errors might arise from using this technique?

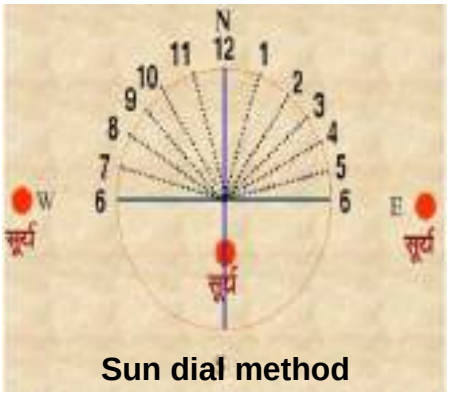
PART IV: METHODS USED TO FIND OUT NORTH

14. **Methods of finding North**. There are many methods to find the general direction of North during the day and night, which are as follows:-**By Compass**. The best method to know the north direction is the compass. The needle of compass always points towards the North Pole. The compass needle glows at night, so north can be find at any time of the day or night.

Sun Method

(a) **By Sun**. The north direction can be determined by the sun, as it rises in the east and sets in the west. When facing the sunrise, east is in front, west behind, north to the left and south to the right.

(b) **By Sun Dial**. Place a stick vertically in the ground in an open area. Mark the tip of the shadow (this will be the westernmost point). Wait for about 15–30 minutes, then mark the tip of the shadow again (it will move eastward). The line between the two marks runs roughly from west to east. Stand with the first mark (west) on your left and you will face north. At 12 noon, the stick's shadow will always align straight, with the north direction in front of you and south behind, revealing the true north-south line.



Sun dial method

(c) **By Grave Yard**. In many cultures, graveyards follow a particular orientation where graves are placed with the head of the deceased facing **east** or **west**.

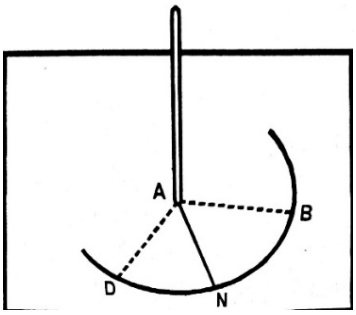
(d) **By Mosque**. In India, by standing with your back to the mosque's dome, you'll face west, with north on your right and south on your left, revealing the direction of true north. The two minaret walls and vaulted dome help indicate this orientation.

(e) **By Shivalay**. This method can help determine the approximate north direction using a Shiva Linga in Indian temples, which is believed to be connected to Mount Kailash. When water is poured onto the Shivling, it flows toward the north, revealing the direction, though this method is not highly reliable.

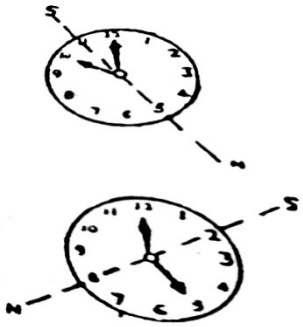
(f) **By Pole Star**. In the Northern Hemisphere, the North Star can help determine the north direction, as it always points to the north and remains stable within 2.25 degrees. This bright star is considered the indicator of True North in the Northern Hemisphere, marking the north position accurately within about 2 degrees.

(g) **Equal Altitude Method**. This is a correct way to find north, but it takes a long time and cannot be done without sunlight. In this method, place a pencil in a vertical position and mark point 'A' at the base of the pencil. Mark point 'B' at the end of the

pencil's shadow. Measure AB and draw a half-circle. At noon, wait until the shadow of the pencil touches the boundary of the half-circle. Mark this as point 'D'. Then draw a line AN through the midpoint of the angle formed by the shadow lines. This AN line indicates True North.



(h) **Watch Method**. In the Northern Hemisphere, point the hour hand towards the sun and halfway between it and 12 o'clock will show south, with the opposite direction indicating north. In the Southern Hemisphere, point the 12 o'clock mark towards the sun and halfway between 12 and the hour hand will show north.



CONCLUSION

15. Understanding directions is fundamental for navigation and especially vital for military purposes, such as map reading for NCC cadets. The north direction is of paramount importance, as it serves as a reference point for both ground navigation and map interpretation. The various methods to find the north, including by compass, the sun, the pole star and even using specific cultural or environmental indicators, provide multiple options for determining direction in different conditions. Understanding the variations between all the three norths, is crucial for accurate navigation. Mastery of these methods ensures that individuals can effectively navigate and orient themselves, whether on land or whilst using maps.

SUMMARY

- Knowing directions is essential for reaching the right destination and is a fundamental skill for military purposes and NCC cadets, especially in map reading.
- There are different methods to find the north direction, which vary between day and night.
- **Cardinal Directions**. North, South, East and West (360°, 90°, 180°, 270° respectively).
- **Intermediate Directions**. are sub-directions between cardinal directions.
- **Minor Directions**. Eight directions between cardinal and intermediate, divided by 22.5°.
- Types of north are True North, Grid North, Magnetic North.
- **Angle of Convergence**. Difference between true north and grid north.
- **Magnetic Variation**. Difference between true north and magnetic north.
- **Local Variation**. Difference between grid north and magnetic north at a given place.

- There are many Methods to Find North during day and night.
- The sun rises in the east and sets in the west. Standing facing the sun, the directions are East (front), West (back), North (left), South (right).
- **By Pole Star**. In the Northern Hemisphere, the Pole Star points to the north. It's a stable reference for north.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What are the three types of directions?

(a) Cardinal, Sub-cardinal and Intermediate
(b) Major, Minor and Intermediate
(c) Major, Intermediate and Minor
(d) North, South and West

Q2. Which of the following is a major cardinal direction?

(a) North-East (c) North-East-West
(b) South (d) West-South

Q3. How many cardinal directions are there?

(a) 2 (b) 8 (c) 4 (d) 16

Q4. Which of the following is NOT an intermediate direction?

(a) North-East (b) South-East (c) West (d) North-West

Q5. What is the angular distance between cardinal directions and intermediate directions?

(a) 15° (b) 22.5° (c) 45° (d) 90°

Q6. What is the total number of directions when combining cardinal, intermediate and sub-intermediate directions?

(a) 4 (b) 8 (c) 16 (d) 12

Q7. What is True North?

(a) The north direction pointed by a compass
(b) The north indicated by grid lines on a map
(c) The north determined by the pole star
(d) The north direction during the day

Q8. Which type of north is represented by the red or purple line on map?

(a) Magnetic North (c) True North
(b) Grid North (d) Local North

Q9. What does the term “magnetic north” refer to?

(a) The north indicated by the pole star
(b) The north indicated by grid lines on a map
(c) The direction the compass needle points to
(d) The north shown at the equator

Q10. What is the angle of convergence?

(a) The difference between magnetic north and true north
(b) The angular difference between grid north and magnetic north
(c) The angular difference between true north and grid north
(d) The difference between cardinal and intermediate directions

Q11. How are intermediate directions named?

(a) Based on the division of cardinal directions into four equal parts
(b) By combining adjacent cardinal directions
(c) By dividing the Earth into equal geographical regions
(d) Based on magnetic properties

Q12. What is the main feature of sub-intermediate directions?

(a) They divide the Earth into two equal halves
(b) They are named after the cardinal direction
(c) They are located at 45° intervals between cardinal and intermediate directions
(d) They are used for space navigation

Q13. How is the back bearing calculated if the forward bearing is 60°?

(a) Back Bearing = 60° + 180° = 240°
(b) Back Bearing = 60° - 180° = -120°
(c) Back Bearing = 60° + 90° = 150°
(d) Back Bearing = 60° + 45° = 105°

Q14. What is the "angle of convergence" in navigation?

(a) The difference between true north and magnetic north
(b) The angular difference between true north and grid north
(c) The angle between the observer and the object
(d) The angle between the two geographic poles

Q15. Which method can be used to find the north direction using the Sun?

(a) By watching the Sun's reflection in water
(b) By noting where the Sun rises and sets
(c) By using the shadow of a vertical stick at noon
(d) By observing the position of the moon

Short Answer Questions

Q1. What are the four main cardinal directions?

Q2. How many intermediate directions are there and how are they named?

Q3. What is the angle difference between cardinal and intermediate directions?

Q4. What is the angle of convergence (Grid Convergence)?

Q5. What are different types of bearing?

Long Answer Questions

Q1. Explain the concept of cardinal directions, intermediate directions and sub-intermediate directions. How are they categorized and what is the total number of directions?

Q2. Describe the three types of north (True North, Grid North and Magnetic North) and explain their differences?

Q3. What is the "Variation Between North Lines"? Discuss the three types of variations: Angle of Convergence, Magnetic Variation and Local Variation?

Q4. Explain different types of bearings.

Q5. What are methods of finding north? Give any 03 methods.

MAP READING

CHAPTER MR-IV: TYPES OF COMPASS & ACQUIRING BEARING

TEACHING INSTRUCTIONS

Period	**:**	**02 (80 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**PI Staff**

Training Aids: Classroom, Prismatic compass, Map, Screen, Pointer Staff, Presentation, Precis Flagged or Lesson Plan in File, Board, Markers, Display Charts.

Time Plan

- **Introduction : 03 Mins**
- **Part I : 07 Mins**
- **Part II : 10 Mins**
- **Part III : 10 Mins**
- **Part-IV : 05 Mins**
- **Conclusion : 05 Mins**
- **Practice : 40 Mins**

INTRODUCTION

1. The Prismatic compass is a navigating tool used to find magnetic bearings. It has been used extensively in the army, ships and aircraft for navigation and to find and maintain direction. There are two types of prismatic compass with which one magnetic bearing can be measured on the ground. Compass error is there due to material used in its manufacturing which causes deviation of magnetic needle from actual north.

Liquid Prismatic compass

Dry Lensatic compass

PREVIEW

The lecture will be conducted in the following parts:-

- **Part I- Magnetic Compass and its types.**
- **Part II- Parts of Compass.**
- **Part III - How to take bearing.**
- **Part-IV - Compass error.**

LEARNING OBJECTIVES

- **To familarise with different types of Magnetic Compasses & understand their difference**.
- **To learn the parts of Parts of Prismatic Compass**.
- **To understand the mechanics of taking Bearing**.
- **To learn the reasons for Compass error and to factor the same whist taking bearing**.

PART I: MAGNETIC COMPASS AND ITS TYPES

2. **Magnetic Compass**. A magnetic compass is a navigational instrument used to determine direction relative to the Earth's magnetic poles. It works based on the Earth's magnetic field, which causes a magnetic needle inside the compass to align with the Earth's magnetic north.

DID YOU KNOW?

- During ancient history, magnetic compass called "*Matsya yantra"* was used for navigation by our ancestors in the 4th and 5th centuray AD. A prismatic compass can be used to measure all bearings from 0° to 360°.

3. **Types of Compasses**. Compass is mainly classified into two types: Liquid Prismatic compass and Dry Lensatic compass.

(a) **Liquid Prismatic Compass**. The Prismatic compass is a navigating tool with a transparent lid and magnetic needle, used for find directions and to measure bearings between two points by sighting through a prism. Without moving the eye, it is possible to sight the object and read bearing on the graduated dial at the same time.

(b) **Dry Compass (Lensatic Compass)**. The Dry Compass is a round box shaped mechanism which is set on a flat base plate helps in finding direction or bearing on ground. It is also used for orienting the map with the ground and helps in navigation. It is very sensitive and is used as a standard compass. To read bearing on Dry compass, open the compass so that the cover is at 90 degrees to the base and the lens bracket is at about 30 degrees with the vertical.

4. A dry military compass is better than other compasses because of its few special features, which are as follows:-

(a) **Induction Damped Needle**. These have been imposed for slowing down the rotation of the magnetic needle.

(b) **Aluminium Body Frame**. Aluminium metal frame makes this compass light weight (5.3 ounces with Line yard) but strong.

(c) **Waterproof**. It can be used even during rains as it is waterproof.

(d) **Climate Capacity**. Climate capacity of Military Compass is -500°F+1500°F. Due to this feature, this compass can be used in any weather conditions.

PART II - PARTS OF PRISMATIC COMPASS

5. **Parts of Prismatic Compass**. The parts of Prismatic Compass with their characteristics are as follows:-

(a) **Lid**. It is used as cover of the compass which Comprises of tongue, tongue notch glass window.

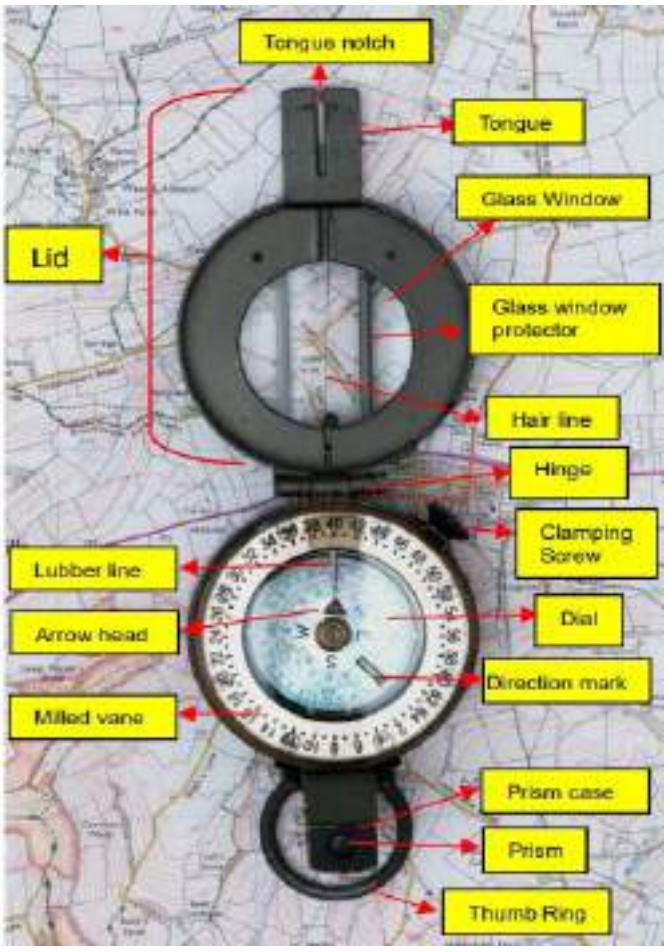
(b) **Tongue**. It is fitted to the Lid, which is used to lift the lid from outside and to keep the dial clear when the compass is not in use. It is also used during night march.

(c) **Tongue Notch**. It is a cut at the Centre of tongue used to align the compass with target and used in setting of map.

(d) **Glass window**. It is the transparent part of lid used to see the target.

(e) **Glass window protractor**. It is the metallic part of the lid used to protect glass window.

(f) **Hair line**. It is used to align the compass with the target to read the bearing precisely.



(g) **Hinge**. It is used to join lid of compass with compass box.

(h) **Card or Dial**. To read the glass directly, the four cardinal directions are marked on dial with degrees and reverse bearing are marked to read the prism.

(j) **Glass plate or Milled Vane**. It is movable and marked with degrees, which may be set for marching on a bearing.

(k) **Arrowhead**. It indicates magnetic north and always points in the direction of north.

(l) **Prism**. It is positioned near the graduated circle for accurate reading of bearings. Magnifies the readings and ensures clear visibility of measurements.

(m) **Prism case**. It covers the prism to protect it from dust and moisture and raised and lowered to focus and read the bearing on dial.

(n) **Clamping Screw**. It is used to clamp the glass plate and then milled vane is easy to move and it is easy to set it with lubber line during night march.

(o) **Lubber line**. The lubber's line is a line on the compass used to indicate the direction in which the individual is heading during night march.

(p) **Direction Mark**. This is made up of radium which glows in dark therefore is used during night march.

(q) **Thumb ring**. It is used to hold the compass while taking bearing of an object.

INTERESTING FACTS

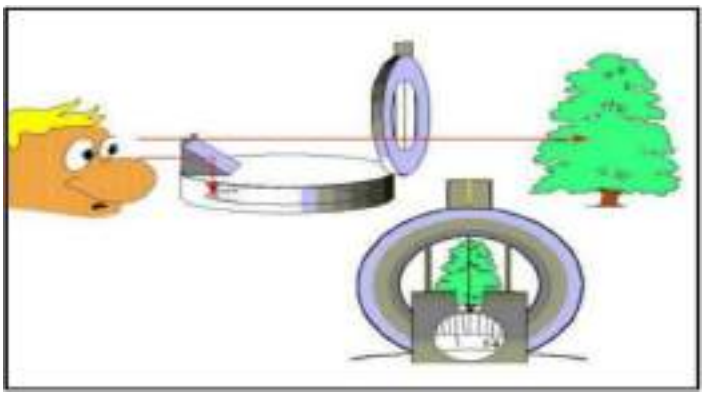
- The Liquid compass is used as a steering compass as oscillations of magnetic needle are damped in the liquid.
- The dial of compass is painted with radium to read bearing during night.

PART III: HOW TO TAKE BEARING WITH MAGNETIC COMPASS

6. **Reading bearing with a compass**. The magnetic bearing can be measured by magnetic compass in following steps:-

(a) Stand facing the direction of the object to read bearing with the compass.

(b) Open the window at 90 degrees and keep the prism over the milled vane and held the compass box with the thumb in thumb ring and the forefinger near hinge supporting lid and align the hairline with the target.



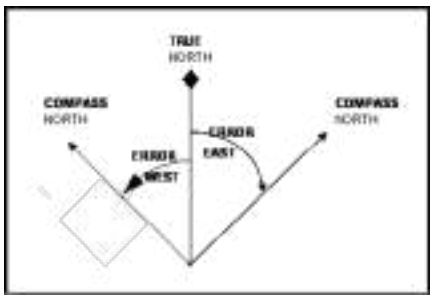
(c) At the same time look at the dial scale through the prism by raising or lowering its case and read the required bearing when arrowhead comes to rest.

(d) When see through the prism, readings increase from right to left as seen through the prism.

(e) This bearing will be a forward bearing.



PART IV – COMPASS ERROR



7. **Compass Error**. Compass error means that the compass needle is pointing slightly right or left instead of exactly at $360^{o}/0^{o}$ degrees. Based on where the compass needle is pointing left or right will define the type of compass error. If the needle points left(west), the error will be subtracted and if the needle points right (east), compass error will be added to obtain the correct bearing.

8. **Local Magnetic Attraction (Deviation)**. Local Magnetic deviation is a magnetic interference in the compass reading caused due to local magnetic attraction or magnetic fields generated by things like electrical systems or ferrous materials. This local magnetic attraction can interfere with the compass needle, cause deviation from the true magnetic north and lead to erroneous reading.

9. If there is an error on the right or left of the compass, then the compass should be read as follows:-

(a) **East Compass Error**. If there is a mistake of 2 degrees east in the compass, then the compass bearings will be 2 degrees less at the time of the bearing, because the needle will start the bearings from 2 degrees ahead. Adding 2 degrees to the compass bearing with a fault of 2 degrees east will reveal the correct magnetic bearing.

(b) **West Compass Error**. If there is a mistake of 2 degrees west in the compass, then the compass bearings will be 2 degrees more at the time of the bearing, because the needle will start the bearings from 2 degrees ahead. Subtracting 2 degrees to the compass bearing with a fault of 2 degrees west will reveal the correct magnetic bearing.

Example 1: If the magnetic bearings of an object is 118° with a compass having east compass error of 2° east. What will be the correct bearing of that object?
Solution: With east compass error of 2° magnetic bearing of object = 118°
Correct bearing = 118° + 2° = 120°

Example 2: If the magnetic bearings of an object is 86° with a compass having west compass error of 2° west. What will be the correct bearing of that object?
Solution: With west compass error of 2° magnetic bearing of object = 86°
Correct bearing = 86° - 2° = 84°

Example 3: If the magnetic bearings of an object is 48° taken with a compass with 1° east error and a magnetic attraction of 2° to the west. What is correct magnetic bearing?
Solution: With east compass error of 1° magnetic bearing of object = 118°
Correct bearing = 48° + 1° = 49°

Correct bearing with mag attraction of 2° to the west = 49°- 2° = 47°

DID YOU KNOW

- Error in the reading of compass occurs due to local magnetic attraction or compass error. Compass error occurs due to two reasons:
  - Manufacturing defects
  - Mishandling

HOT

- Evaluate the importance of checking the compass for correctness and errors before use. What could be the consequences of neglecting this step?
- What could be the potential consequences of using a Prismatic Compass with a malfunctioning needle due to interference from a nearby magnetic field?

CONCLUSION

9. Prismatic compass is most important for soldiers, cadets and any individual to have command on Map Reading. The user should know the types of compasses, different parts of compass and its use i.e. how to navigate on compass bearing. While using the compass ensure that there is no iron object nearby as it may cause deviation. Before using a compass, errors and correctness should be checked.

SUMMARY

- The Prismatic compass is a navigating tool used for determine directions and to measure bearings or angles between two points by sighting through a prism used in surveying.
- Two types of compasses are liquid Prismatic compass and Dry compass.

- The Liquid compass is used as a steering compass.
- The dry card compass is very sensitive and light weight.
- The main parts of compass are Lid, tongue, Hing, Clamping screw, Glass window, Hair line, Glass plate, Dial, Arrowhead, Lubber line, Direction, Prism, Prism case, Thumb ring.
- To read bearing on compass, open the window at 90 degrees and hold the compass box with the thumb ring and align the hairline with the target.
- Compass error means that the compass needle is slightly right or left instead of exactly at 360 degrees.
- The Compass Error occurs mainly due to local magnetic attraction or magnetic fields generated by electrical systems or ferrous materials.

ASSEMENT EXERCISE

Multiple Choice Questions

Q1. Prismatic Compass is a _____ tool.

(a) Aluminium
(b) Survey
(c) Navigation
(d) None of these

Q2. Compass is used to find _____ bearing.

(a) Backward
(b) Forward
(c) True
(d) Grid

Q3. _____ is used as cover of compass.

(a) Glass van
(b) Lid
(c) Glass window protractor
(d) Glass window

Q4. Bearing is set on _____ for marching.

(a) Milled vane
(b) Lid
(c) Dial
(d) Lubber line

Q5. What is the weight of Dry Military Compass (including lanyard)?

(a) 5.2 ounces
(b) 4.3 ounces
(c) 5.3 ounces
(d) 4.2 ounces

Q6. The Arrow head indicates–

(a) Direction of marching
(b) Magnetic variation
(c) Deviation
(d) Magnetic north

Q7. The movable part of the compass which is marked with degrees is called–

(a) Hinge
(b) Prism
(c) Dial
(d) Glass Plate

Q8. Which line is used to indicate the direction, on the compass, in which the individual is heading during the night march?

(a) Hair Line
(b) Grid Line
(c) Lubber Line
(d) Direction Mark

Q9. What is the primary function of a prismatic compass?

(a) To measure distances between two points
(b) To calculate the elevation of a point
(c) To determine directions and measure bearings or angles
(d) To calculate the area of a land parcel

Q10. Which of the following is NOT a part of the prismatic compass?

(a) Hairline
(b) Steering wheel
(c) Prism case
(d) Lubber line

Q11. When reading the bearing on a prismatic compass, which of the following should be aligned with the target?

(a) Thumb ring
(b) Hair line
(c) Direction mark
(d) Lubber line

Q12. What is meant by 'Compass Error'?

(a) The angular difference between true north and magnetic north
(b) The difference between magnetic and true south
(c) The alignment of the compass dial
(d) The error in the bearing due to a malfunction in the compass

Q13. The Dry compass is also known as–

(a) Prismatic compass
(b) Survey compass
(c) Lensatic compass
(d) None of these

Q14. Compass Error occurs due to _____.

(a) Magnetic north and true north
(b) Earth’s magnetic field and magnetic interference
(c) Electrical systems and ferrous materials
(d) Both (b) and (c)

Q15. What does "magnetic variation" refer to?

(a) The interference caused by magnetic fields from electrical systems
(b) The difference between true north and magnetic north
(c) The shift in the compass needle due to Earth’s gravitational pull
(d) The misalignment between compass north and geographic north

Short Answer Questions

Q1. Write five parts of a Prismatic Compass.

Q2. What is Dial?

Q3. What is magnetic deviation?

Q4. What is the use of lubber line?

Q5. What causes Compass Error?

Long Answer Questions

Q1. What are the types of Prismatic Compass?

Q2. What are the characteristics of Dry Compass?

Q3. What is Compass Error and its types?

Q4. How to take bearing with Prismatic Compass?

Q5. What is the use of Clamping Screw and Direction mark?

MAP READING

CHAPTER MR-V: SERVICE PROTRACTOR & ITS USES

TEACHING INSTRUCTIONS

Period	**:**	**01 (40 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**1st Year SD/SW**
Conducting Officer	**:**	**PI Staff**

Training Aids: Class Room, Prismatic compass, Map, Screen, Pointer Staff, Presentation, Precis Flagged or Lesson Plan in File, Board, Markers, Graph Pencils, Display Charts.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 10 Mins**
- **Part II : 20 Mins**
- **Conclusion : 05 Mins**

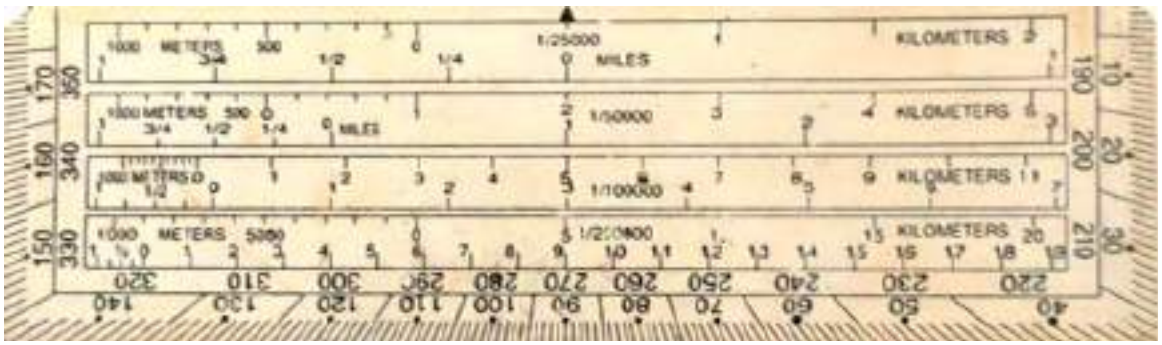
INTRODUCTION

1. The Service Protractor is a essential device which is used in map reading. It can be used to read grid bearing of an object and convert it into a magnetic bearing to locate the object on ground. Conversely, after taking the magnetic bearing of an object on ground it helps in converting the same into grid bearing and subsequent plotting on the map. The protractor provides not only angle measurements, but also had a variety of scales including reference scale and distance scale which helps in finding distance between two objects on the map. The scale lines on the service protractor are drawn exactly the same manner as given at the bottom of the map.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I : Service Protractor and its uses.** ➢ **Part II: Reading and Plotting of Grid bearing with Service Protractor.**	➢ **Understanding Service Protector and its uses.** ➢ **To learn Reading and Ploting Grid Bearing with Service Protractor.**

PART I: FAMILIARISATION WITH SERVICE PROTRACTOR

1. The service protractor is an instrument used for plotting and measuring grid bearing as well as distance between any two objects on the map. It is the essential link between the compass and the map, as magnetic bearings measured with compass can be plotted as grid bearing on the map. Likewise, magnetic bearing of an object obtained by a compass can be converted into grid bearing and plotted on the map. Service Protractor also has a scale similar to the one similar to the one made at the bottom of the map. With this scale the distance of two points on the map can be measured and thereafter, converted to actual distance of two objects on the ground. Service protector is made of either card board, metal or ivory. It is a simple device which is 6 inches long and 2 inches wide. The front face of the protractor is marked with 360° degrees around its three edges. In case of necessity an experienced cadet can make this protector with careful measurement at home also.



Front view of Service Protractor

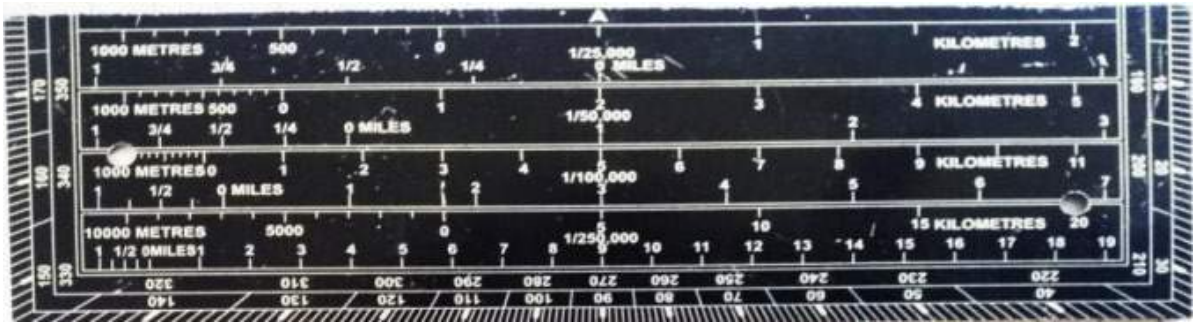
INTERESTING FACTS

- The degrees are marked in a clockwise direction, on outer side starting from 0° to 180° and from 181° to 360° on the inner side of a service protector.
- We can plot and measure grid bearing of any object by keeping small arrow, which is at the centre of the fourth side of the protector, on the object.

3. **Description of Service Protractor**. Service protector is made of either card board, metal or ivory. It is a simple device which is 6 inches long and 2 inches wide. It has two faces, namely front side and back side having different markings. These are explained as under:-

(a) **Front Face**. The front face of the protractor is marked with 360° degrees around its three edges. On the underside where the degrees are marked three (3) double scale lines and two (2) single scale lines were formed. There are primary and secondary parts. The distribution of divisions is given in the table below:-

SCALE	PRIMARY DIVISION	SECONDARY DIVISION
1/50000 .789 Mile = 1”	1 KM 1Mile	100 Metre ¼ Mile
1/100000 1578 Mile = 1”	1KM 1Mile	100 Metre ¼ Mile
1/200000 3156 Mile = 1”	5 KM 1Mile	1 KM ¼ Mile
1/25000 1/250000	500 Metre 1Mile	100 Metre ¼ Mile



(b) **Back Face**. On the other side of it, there are total six scales are marked. One centi-meter scale, one inch scale and four diagonal scales of 1/50,000, 1/25,000, 1/1,00,000 and 1/2,50,000 with sub divisions marked on both edges of service protractor for finding correct grid reference of respective scales. Its name and mark are written in the empty space in the middle.

PART: II READING AND PLOTTING OF GRID BEARINGS WITH SERVICE PROTRACTOR

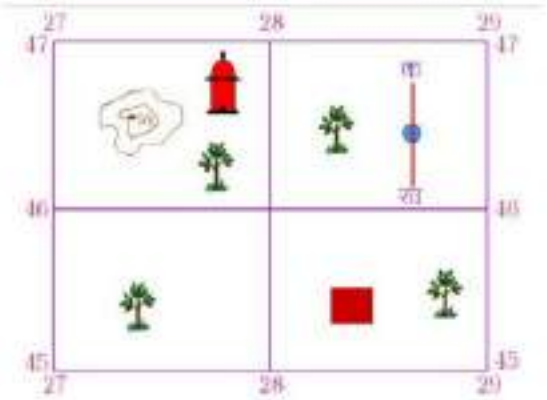
4. **Method of Using Service Protractor**. Before using a service protractor, it is important to know that the object is at which side of map, from which bearings are to be read. See whether it is in the east on the right or in the west on the left. If the object is in the east, the arrow in the centre of service protractor will be placed at the object and place the edge marked with degrees in the east. If the object is in the west, the arrow will be placed at the object and place the edge marked with degrees in the west.

5. **Reading bearing with Service Protractor**. If you want to read the bearings of one place from another place (source), then draw a line with sketch or pencil joining both places. Keep service protractor parallel to easting grid lines.

(a) If the object whose bearing is to be detected is in the east of another object, then place the arrow (zero edge) on source object and read outer bearing (ranging from 0° to 180°).

(b) If the object whose bearing is to be detected is in the west of another object, then place the arrow (zero edge) on source object and read inner bearing (ranging from 181° to 360°).

For measuring grid bearing of temple from contour, we place arrow (zero edge) of service protector on centre of contour and



USES OF SERVICE PROTRACTOR

- For reading and plotting grid bearing of the map.
- Can read forward bearings and back bearings together.
- Can measure distance between two objects on the map.
- Diagonal reference scale can used for finding 6 figure grid reference accurately.
- Can read and plot 0 to 360 degrees on map.
- Can find degree of slope.
- Helps draw parallel lines on maps.
- Helps measure hundredth part of 1 cm or an Inch.

6. **Plotting Bearings on Map**. For plotting bearing on map, first convert magnetic bearing into grid bearing than plot grid bearing on map. For example:-

(a) In given figure if magnetic bearing of church at GR 167287 from a fort at GR 152305 is 145°

(b) The difference between grid north and magnetic north is 5°.

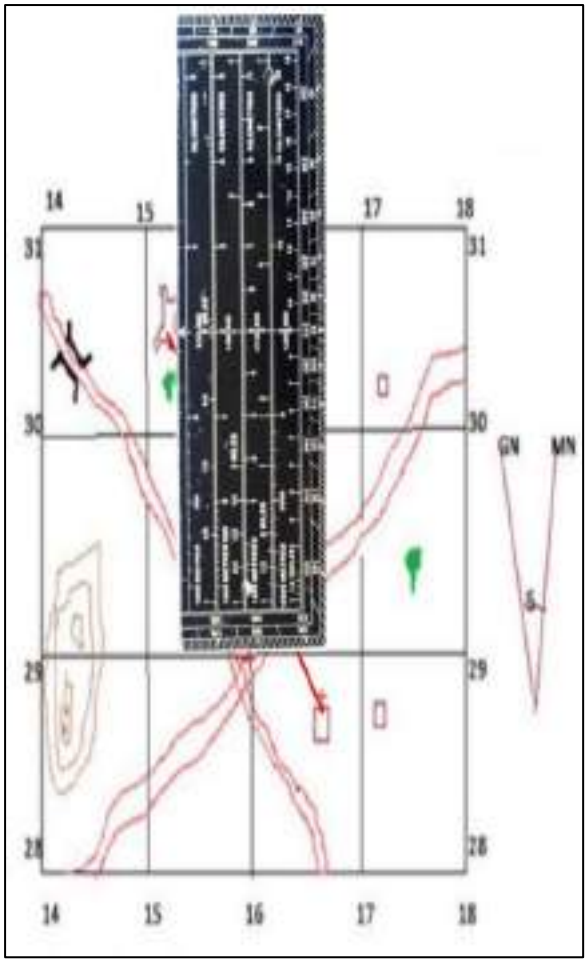
(c) By adding 5°, convert magnetic bearing into grid bearing.

(d) Add 5° to 145°.

(e) Grid bearing of church from fort is 150°.

(f) Put arrow (zero edge) of service protractor on fort, parallel to easting grid lines.

Mark a point on 150°and draw a line from fort to that point which will meet at church.



HOT

- Imagine you are using a Service Protractor to plot the bearing of a distant object. What steps would you follow to ensure that the bearing is correctly plotted on the map.
- Evaluate the importance of understanding the positioning of an object (east or west) when using the Service Protractor. How could incorrect placement of the arrow impact the results?
- Compare the use of the Service Protractor on maps with different scales (e.g., 1/50000 vs. 1/100000). How does the scale affect the precision of plotting bearings?

CONCLUSION

7. Service Protractor is a crucial tool for accurately converting magnetic bearings to grid bearings, facilitating the process of finding and plotting the bearings of objects on a map. The protractor's various scales, including those for different map ratios, further enhance its utility by aiding in grid reference calculations. Through its method of use, the Service Protractor ensures that bearings are correctly read and plotted, making it an indispensable instrument for navigational tasks that require precision and reliability.

SUMMARY

- Service Protractor a tool that converts magnetic bearings to grid bearings, linking a compass to a map.
- Used to find and plot the bearing of an object by converting it into a magnetic bearing, which can be set on a compass to locate the object.
- Includes a protractor that offers angle measurements and a variety of map scales.
- The underside features markings for degrees and multiple scales (primary and secondary divisions) for measuring distances on maps.
- Different scales (e.g., 1/50000, 1/100000, 1/200000, 1/25000) on Service Protractor are used for distance calculations on maps.
- These scales measure distances in miles, kilometres and meters, with sub-divisions for precision.
- The protractor also features scales for centimetre, inch and diagonal measurements (e.g., 1/50,000, 1/25,000).
- For using the Service Protractor determine the location of the object (east or west) on the map. Place the zero edge (arrow) at the object, aligning the degree-marked edge accordingly (east for objects in the east and west for objects in the west).
- Read the bearing on the protractor by matching the object's position relative to the grid lines.
- For objects east of the source: Read the outer bearing (0° to 180°).
- For objects west of the source: Read the inner bearing (181° to 360°).
- Ensure the zero edge of the protractor is aligned parallel to the grid lines for accuracy and now.

ASSESSMENT EXCERCISE

Multiple Choice Questions

Q1. What is the use of the Service Protractor?

(a) To measure the distance between two points
(b) conversion of magnetic bearings into grid bearings
(c) To calculate the area of a map
(d) To locate north on a compass

Q2. What materials are used to make a Service Protractor?

(a) Wood and plastic
(b) Cardboard, metal and ivory
(c) Glass and rubber
(d) Steel and plastic

Q3. What does the Service Protractor help in measuring between two points on a map?

(a) Temperature (b) Elevation (c) Bearing (d) Area

Q4. Which of the following is NOT a scale marked on the Service Protractor?

(a) 1/50,000 (b) 1/25,000 (c) 1/5,000 (d) 1/100,000

Q5. How many primary and secondary scale lines are on the underside of the Service Protractor?

(a) Four primary and three secondary
(b) Three primary and two secondary
(c) Five primary and four secondary
d) Two primary and one secondary

Q6. Which scale is used for measuring 1 KM on a 1/50000 scale map?

(a) 1 Mile (b) ¼ Mile (c) 100 Metres (d) 1 meter

Q7. What is the purpose of the diagonal scales on the Service Protractor?

(a) To measure distance in kilometres
(b) To plot bearing points
(c) To find the correct grid reference of respective scales
(d) To measure elevation

Q8. How should the Service Protractor be placed when measuring bearings from an object in the east?

(a) Place the zero edge in the west
(b) Place the arrow on the object and mark the degree scale in the east
(c) Place the zero edge in the west
(d) Place the Service Protractor at the top of the map

Q9. If an object is in the west, where should the Service Protractor's arrow be placed?

(a) On the top of the map
(b) At the west of source object
(c) On the bottom of the map
(d) In the middle of the map

Q10. What is the range of the outer bearing on the Service Protractor when the object is in the east?

(a) 0° to 90° (b) 0° to 180° (c) 180° to 360° (d) 90° to 180°

Q11. What is the range of the inner bearing on the Service Protractor when the object is in the west?

(a) 0° to 90° (b) 90° to 180° (c) 181° to 360° (d) 360° to 540°

Q12. What must be done first when plotting a bearing on a map using the Service Protractor?

(a) Draw a line between two points
(b) Convert magnetic bearing into grid bearing
(c) Mark the map with elevation data
(d) Mark the distance of two objects

Q13. What is the grid bearing of an object if the magnetic bearing is 135° and the difference between magnetic north and grid north is 5° and grid north is in west of magnetic north?

(a) 150° (b) 140° (c) 145° (d) 135°

Q14. What is the purpose of the protractor on the Service Protractor?

(a) To measure distances on the map
(b) To convert grid bearings into magnetic bearings
(c) To provide angle measurements
(d) To determine the area of the map

Q15. How many scales are there on back side of Service Protractor?

(a) 4 (b) 6 (c) 3 (d) 7

Short Answer Questions

Q1. What is the primary function of a Service Protractor?

Q2. What materials are used to make a Service Protractor?

Q3. What scales are marked on the Service Protractor?

Q4. How do you use the Service Protractor to measure bearings?

Q5. What is the first step when plotting a bearing on a map with the Service Protractor?

Long Answer Question

Q1. What is Service Protractor?

Q2. What are uses of Service Protractor?

Q3. How to plot bearing on map?

Q4. Give description of Service Protractor?

Q5. If magnetic bearing is 266° and difference between grid north and magnetic north is 5°. Grid north is in east of magnetic north. Calculate grid bearing.

MAP READING

CHAPTER MR-VI: SETTING OF A MAP, METHODS OF FINDING OWN POSITION

“Map setting, north orientation and position are crucial for navigation.”

TEACHING INSTRUCTIONS

Period	**:**	**06 (240 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**1st (02), 2nd (02) &3rd Year (02) SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Map sheets, Compass, Service Protractor, Pointer, Charts, Black board & Chalk.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 35 Mins**
- **Part II : 35 Mins**
- **Conclusion : 05 Mins**
- **Practice : 160 Mins (04 periods)**

INTRODUCTION

1. This lecture aims to equip NCC Cadets with the fundamental skills required for effective map reading and navigation. These abilities are crucial for interpreting terrain, planning routes and safely navigating during field operations or outdoor activities. The lecture will focus on practical techniques for setting a map, identifying directions and determining one's location, providing cadets with confidence and precision in the field. Cadets will learn two key methods for setting a map: using a compass to align magnetic north with the map and using visible landmarks to match terrain features with the map. The lecture will also cover methods like resection, which involves bearings to known landmarks and inspection, which relies on comparing terrain features, to determine their position on the map.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Methods of Setting a Map.** ➢ **Part II: Finding Own Position on the Map.**	➢ **Understanding and applying methods to set a map**. ➢ **Learn techniques to determine own position**. ➢ **Understanding Resection and Inspection methods**. ➢ **Developing practical navigation skills**.

PART I: METHODS OF SETTING A MAP

2. **Setting of a Map**. To "set" a map means to orient it so that it matches the real-world direction on the ground. More specifically, it means ensuring that **North** on the map aligns with **North** on the ground. When a map is properly set, the physical features on the map will match up correctly with the actual features on the ground, making it much easier to read and use.

DID YOU KNOW?

➢ Setting a map ensures that directions and bearings are correctly interpreted. It makes it easier to plan routes and understand your surroundings.

3. **Methods of Setting a Map**. There are two primary methods for setting a map:-

(a) By Compass.

(b) By Objects on the Ground.

4. **Setting a Map Using a Compass**. The compass method is one of the most common and reliable ways of setting a map. Here's how you can do it:-

(a) Spread the map on a levelled ground. On Topographical maps besides grid lines, 3-4 Black lines are drawn vertical and horizontal.

(b) These lines are longitudes and latitudes. The vertical lines indicate true north.

(c) Now open the compass and put it on one of this longitude (vertical black line) in such a way that its tongue notch, hairline and thumb ring notch cover the black line, while putting compass on a line, it is ensured that compass lid should point north of the map (grid north).

(d) Now without moving compass, move map in such a way so that arrow mark on the compass come in line with hair line at 360 degrees. Now map is set.

5. **Setting a Map Without a Compass**. If you don't have a compass, there are still ways to orient your map based on visible landmarks. These methods rely on natural features around you to set the map.

(a) **Using a Straightedge (eg, Railway Line)**. Recognize a well-defined, straight feature on the map, such as a railway line, road,or river. Find this feature on the ground and align your position along it. Hold the map in such a way that the object you see on the ground aligns with the corresponding feature on the map. This will allow you to orient the map to the ground.

(b) **Recognizing and Joining Landmarks**. Identify one object on the map and the corresponding object on the ground. It could be a mountain, tower, or other prominent feature. Line up your position on the map with the landmark on the ground. Holding the map steady, ensure that when you look in the direction of the landmark, it lies in a straight line between you and the map. This sets the map in the correct orientation.

(c) **Parallel Method**. This method involves recognizing two landmarks visible on both the map and on the ground. These could be roads, rivers, or other distinct features. Even if these landmarks are not visible continuously, you can choose two landmarks that are located on the map and on the ground. Hold the map so that the two landmarks on the map are parallel to the two corresponding landmarks visible on the ground. This will give you a rough orientation of the map.

(d) **On/Near Line Joining Two Points**. Identify two landmarks that are nearby, either on the map or on the ground. Stand on an imaginary line joining these two points. Once you do this, you can position the map so that the two landmarks on the map are aligned with the real-world counterparts.

DID YOU KNOW?

- As magnetic variation in India is very small so setting of map is almost correct without considering magnetic variation.
- Compass Error and Local Magnetic Attraction should be taken care of while using a Compass.

PART II: FINDING OWN POSITION ON THE MAP

6. **Finding Your Own Position on the Map**. Knowing your position on a map is vital for navigation. Knowing own position is the primary step of learning map reading as well as developing basic navigation skills with the help of map and compass. In simple words the term 'Finding own position' refers to locating one's own position on the map exactly as per actual position on ground.

7. **Methods of Finding Own Position**. Finding own position is a relatively easier task if the location of the observer is close to or is at a clearly identifiable features/objects which can be seen both on ground as well as on map. In such cases, inspection method can be use to find the own location. However, a cadet may be in a situation where he finds himself in a unknown area, not having any clearly identifiable and known features/objects which are available both on map as well as ground. In such cases resection method must be used to find own position. There are two methods to find own position described in succeeding paragraph.

8. **By Inspection Method**. Align the map with visible features on the ground. Compare the map's details (e.g., rivers, buildings) with the surroundings to estimate your position. This is the easiest as well as most reliable method of finding own position for which it is essential to know how to identify manmade and natural features of ground on map, also one must have good practice of identifying the feature on ground through the help of information provide by map. For which following things are necessary:-

(a) Have a good knowledge of map reading.

(b) One must have proper estimation of the area in which the own position is required to find.

(c) There should be a land mark around the place to be found in the map.

(d) The cadet should carry out continuous map reading whilst arriving at the new location to use inspection method effectively.

Inspection method consists of:

- Setting of maps
- Recognition of general area of own position on the map.
- A close study of the ground details.
- Continuous map reading

9. The inspection method in map reading is a simple technique used to approximate your location by visually matching the terrain features around you with corresponding features on a map. Unlike more precise methods like resection, the inspection method relies on observation and recognition rather than measurements with a compass.

10. **Advantages of Inspection Method**.

(a) **Quick and Easy**. No special tools (like a compass or protractor) are needed.

(b) **Practical**. Useful for casual navigation when precision isn't critical.

11. **Disadvantages of Inspection Method**.

(a) **Less Accurate**. The method is approximate and can be prone to errors.

(b) **Dependent on Visibility**. It requires clear visibility of recognizable landmarks.

(c) **Subjective**. Estimation of position varies depending on the user's observation skills.

12. **When to Use the Inspection Method**.

(a) In good weather with clear visibility.

(b) When you need a quick approximation of your location.

(c) In areas with distinct and easily identifiable terrain features.

13. This method is commonly used by hikers, scouts and in casual navigation scenarios when precision isn't necessary. However, for more accurate navigation, combining it with tools like a compass or GPS is recommended.

14. **Resection Method (With Compass)**. Identify two or three visible landmarks on the map as well as on the ground. Use a compass to find their bearings, then plot back bearings on the map. The intersection of the lines is your location. Resection Method (With Compass) explained in detail in next chapter.

15. **Advantages of Navigation by Compass**.

(a) **Simplicity**. A compass is easy to use and does not require batteries or advanced technology. It works reliably in almost any condition.

(b) **Global Use**. It can be used anywhere on Earth, including remote areas, forests, mountains or at sea, making it a versatile tool for travellers, hikers and sailors.

(c) **Durability**. A compass is generally a rugged, durable tool that can withstand harsh outdoor environments, such as rain, wind and cold temperatures.

(d) **No Need for Satellites**. Unlike GPS, a compass doesn’t rely on satellites or signals, making it a reliable tool in areas with poor satellite coverage or when technology fails.

16. **Disadvantages of Navigation by Compass**.

(a) **Magnetic Interference**. The compass can be affected by magnetic fields from nearby metal objects, electrical equipment, or even large geological deposits, leading to inaccurate readings.

(b) **Requires Skill**. Effective use of a compass requires knowledge of how to read it properly, understand maps and orient the compass with the environment, which can be challenging for beginners.

(c) **Limited Information**. Unlike GPS, a compass only shows direction and does not provide information on specific locations, distances, or real-time updates, requiring additional tools like maps.

(d) **Not Suitable for Urban Areas**. In densely built environments, such as cities with large buildings and metal structures, the compass can be less reliable due to interference from surrounding materials.

DID YOU KNOW?

- Sun's Position: Ancient travellers used the sun and shadows to determine direction, a technique still taught in survival training.
- North Star: Polaris, a fixed point in the northern sky, has guided navigation for centuries, aiding explorers and sailors.

HOT

- How would you determine your position on a map if you were lost in a dense forest with no compass or visible landmarks?
- Compare the accuracy of the Equal Altitude Method and the Resection Method. Which one would you prefer in varying terrains, and why?
- How can traditional navigation methods (e.g., watch method, star navigation) complement GPS technology in remote or challenging environments?

INTERESTING FACTS

- **Star Navigation: Ancient sailors and explorers, including Egyptians and Polynesians, used the North Star (Polaris) and the night sky for navigation long before modern tools became available**.

CONCLUSION

17. The lecture provides a comprehensive understanding of the essential skills for map reading and navigation. By learning how to set a map using a compass or landmarks, determine true north using natural indicators and find their own position on a map, cadets will be equipped with the practical skills needed for effective navigation in the field. These foundational skills are crucial not only for military operations but also for personal safety and confidence when traveling in unfamiliar or remote areas. Mastering these techniques ensures cadets can navigate independently, regardless of the availability of modern technology or equipment.

SUMMARY

- **Setting a Map:** Align the map with the real-world environment to ensure its features correspond to the terrain accurately.
- **Using a Compass:** Learn to draw a magnetic north line, adjust for magnetic variation and align the map with magnetic north.
- **Using Landmarks:** Orient the map by aligning visible landmarks (roads, rivers, buildings) with corresponding map features, useful without a compass.
- **Pole Star:** Identify true north using Polaris in the Northern Hemisphere.
- **Finding Position with Compass:** Use bearings from three visible landmarks to determine the exact location on the map.
- **Finding Position without Compass:** Use tracing paper to project lines from landmarks and identify their intersection as the location.
- **Position by Inspection:** Match terrain features like hills, rivers, or roads with the map to estimate your position.
- **Practical Applications:** Techniques are crucial for navigating in challenging environments with or without modern tools.
- **Outcome:** Cadets will gain confidence and precision in setting maps, finding directions and identifying their positions.
- Navigation by compass is simple, low cost, versatile covers boarder areas.
- Navigation by a compass is affected by magnetic and electric fields which cause compass error and magnetic deviation.
- Unlike GPS, a compass doesn't rely on satellites or signals, making it a reliable tool in areas with poor satellite coverage or when technology fails.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What does it mean to "set" or "orient" a map?

(a) To draw features on the map
(b) To align the map with real-world objects
(c) To measure distances on the map
(d) To colour the map according to terrain types

Q2. Which of the following is NOT a method of setting a map?

(a) By compass
(b) By using objects on the ground
(c) By drawing landmarks
(d) By using the sun for orientation

Q3. How do you orient a map using a compass?

(a) By aligning the map with true north
(b) By aligning the map's magnetic north with the compass needle
(c) By aligning the map with visible stars
(d) By drawing a magnetic line on the map

Q4. What method can you use to find true north without a compass in the Northern Hemisphere?

(a) Watch method

(b) Equal Altitude method

(c) Using a smartphone GPS

(d) Using a road map

Q5. What is the main advantage of the Equal Altitude Method?

(a) It is quick and easy
(b) It works well on cloudy days
(c) It accurately determines true north
(d) It requires only basic knowledge of the stars

Q6. Which star is used to determine true north in the Northern Hemisphere?

(a) Sirius
(b) Orion
(c) Polaris (North Star)
(d) Betelgeuse

Q7. Which of the following is a method of finding your position on a map?

(a) Map inspection
(b) Resection method with a compass
(c) Checking local weather patterns
(d) Using satellite imagery

Q8. In the resection method, what is used to determine the position on a map?

(a) The position of a compass needle
(b) Bearings from visible landmarks
(c) A GPS device
(d) A topographic map

Q9. What is the purpose of the "By Inspection" method for finding your position?

(a) To calculate precise coordinates
(b) To study and match ground features with those on the map
(c) To draw a new map based on surroundings
(d) To use a compass to measure distances

Q10. Which of the following methods would you use if a compass is unavailable?

(a) Inspection method
(b) Parallel method
(c) Tracing paper method
(d) Magnetic line method

Q11. What is first step for finding own position?

(a) Select four objects on ground
(b) Take grid bearing of identified objects
(c) Setting of maps
(d) Take magnetic bearing of identified objects

Q12. Which of the following can be used to align a map with the ground when no compass is available?

(a) A compass rose
(b) A straightedge or visible landmarks
(c) A protractor
(d) A ruler

Q13. Which feature on a topographical map helps identify true north?

(a) Latitudes (b) Longitudes (c) The compass rose (d) Grid lines

Q14. When setting a map using a compass, where should the compass lid point?

(a) Towards the south of the map
(b) Towards the east of the map
(c) Towards the north of the map
(d) Towards the west of the map

Q15. What is the second method for setting a map without using a compass?
(a) Using a GPS device
(b) Using visible landmarks
(c) Using a straightedge
(d) Using a magnifying glass

Short Answer Questions

Q1. What does it mean to "set" a map?

Q2. What is magnetic declination?

Q3. What is the main purpose of the equal altitude method for finding north?

Q4. In the Resection Method with a compass, what is done after identifying landmarks?

Q5. What feature is primarily compared to locate one's position using the Inspection Method?

Long Answer Questions

Q1. Explain the process of setting a map using a compass?

Q2. Describe how you would determine your position on a map using the resection method with a compass?

Q3. How does the watch method help determine the direction of true north?

Q4. Explain equal altitude method for finding north.

Q5. Describe inspection method for finding own position.

MAP READING

CHAPTER MR-VII: RESECTION METHOD WITH COMPASS

"Sometimes, in order to move forward, we must take a back bearing, retracing our steps to understand how far we've come."

TEACHING INSTRUCTIONS

Period	**:**	**04 (160 Mins)**
Type	**:**	**Lecture and Practice.**
Year	**:**	**2nd(02) and 3rd Year(02) SD/SW**
Conducting Officer	**:**	**Permanent Instructor.**

Training Aids: Map, Compass, service protector, GPS, Activities, Work Sheets, Assignments.

Time Plan

- **Introduction : 05 Mins**
- **Part I : 30 Mins**
- **Conclusion : 05 Mins**
- **Practice exercises(01 period for 1st year) (02 period for 2nd year) : 120 Mins**

INTRODUCTION

1. In this Chapter we will cover concepts such as resection method with compass and inspection method. Back bearing is a concept commonly used in navigation, both in land and marine settings. It refers to the reverse direction of a bearing or course that one has previously taken. The resection method is a fundamental technique in navigation and orienteering, primarily used to determine one's position on a map or in the field. This method involves using known landmarks or reference points in the environment and measuring their bearings (angles) from the observer's current location. By drawing lines from these landmarks on a map based on their respective bearings, the intersection of these lines identifies the observer's position.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Resection method with compass.** ➢ **Part II: Practice exercise.**	➢ **Resection with Compass Method to find own position**. ➢ **Inspection Method when no navigational tools are available**. ➢ **Practice exercises**.

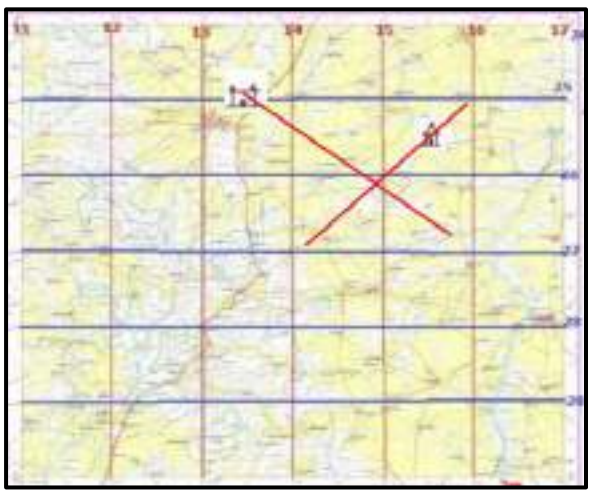
PART I: RESECTION METHOD WITH COMPASS

2. The resection method in map reading is a technique used to determine your own position on a map by identifying and using known landmarks visible in the terrain. This method is particularly useful when you do not know your exact position but can see recognizable features around you. In practice we can calculate bearing of the observer without moving to observer. In other words in map reading and navigation, back bearing (or back azimuth) refers to the direction opposite to a given bearing. It is useful when retracing a path or checking your position by sighting an object in reverse.

3. **Steps in the Resection Method**. Steps for resection method are as follows:-

(a) Identify at least two (preferably three) prominent, identifiable landmarks or objects on the ground (e.g., a hill, a tower, or a building) and find their corresponding locations on the map.

(b) The angle between these three prominent objects must not be more than 100 or less than 30 apart. These objects should be clearly visible from a distance.



(c) Use a compass to measure the magnetic bearing (forward bearing) of each landmark(object) from your current position.

(d) Convert the forward magnetic bearing into Grid bearing with the help of magnetic and grid variation given on the map.

(e) Convert Grid bearing into grid back bearing by adding or subtracting 180^{o}.

(f) The lines of the back bearing of these objects must be plotted on the map with the help of service protector.

(g) The point where these lines intersect indicates your approximate location. If you use three landmarks, the intersection will form a triangle and your position is the centre of triangle.

(h) This method is especially useful when you don't have a direct way of measuring distances to the reference points, but you can see them from your location.

TIPS FOR ACCURACY

- Use distant, distinct landmarks to reduce errors caused by small angle deviations.
- Ensure the compass is held steady and level when taking bearings.
- Double-check the landmarks to avoid misidentifying features.

INTERESTING FACTS

- In marine navigation, back bearings are crucial when returning to a port or retracing a route in open water, helping sailors avoid mistakes in direction and drift.
- The Resection method has been used for centuries in both land and maritime navigation. Early explorers and surveyors relied on this technique to pinpoint their exact location using visible landmarks.

DO YOU KNOW?

Practical Uses of the resection method is commonly employed in:-

- Navigation during hiking, mountaineering, orienteering, and military operations.
- Situations where GPS devices are unavailable or unreliable

PRACTICE EXERCISES

4. **Basic Back Bearing Calculation**. Learn how to calculate a back bearing from a given compass bearing.

Instructions:-

(a) Choose a starting bearing, for example, 75°.
(b) Add 180° to this bearing : 75° + 180° = 255°.

(c) Check if the resulting bearing exceeds 360°. If it does, subtract 360° (e.g., 400° would be reduced to 40°).

(d) The back bearing for 75° is 255°.

Challenge. Try different initial bearings like 120°, 225°, or 310° and calculate the corresponding back bearings.

4. **Using a Compass in the Field**. Practice using a compass to find a back bearing in the field.

Instructions:-

(a) Go outdoors with a map and a compass.

(b) Pick a landmark that you can identify clearly (e.g., a mountain peak or a distant building).

(c) Take a bearing to the landmark using your compass.

(d) Calculate the back bearing by adding or subtracting 180°.

(e) Use the back bearing to walk in the opposite direction and see if you can return to your starting point.

Challenge. Try this with multiple landmarks and ensure you can accurately find your way back.

5. **Landmark Identification Using Back Bearings**. Identify your location based on back bearings from known landmarks.

Instructions:-

(a) Stand at an unknown location and choose two landmarks that you can see.

(b) Take a bearing to each landmark.

(c) Reverse the bearings (find their back bearings).

(d) Using a map, plot the back bearings and identify your approximate location where the lines intersect.

Challenge. Increase difficulty by adding more landmarks or practicing in areas with more complex terrain.

6. **Map and Compass Challenge**. Use a map and compass to practice back bearings and navigate.

Instructions:-

(a) On a map, mark a starting point and a destination.

(b) Take the bearing from your starting point to your destination and then calculate the back bearing.

(c) Walk along the route to the destination.

(d) At the destination, use the back bearing to return to your starting point.

Challenge. Repeat the exercise with different locations and bearings, ensuring accuracy in both directions.

7 **Basic Resection method with known landmarks**. Learn to determine your location (Own Position) by taking bearings from two known landmarks.

Instructions:-

(a) Stand at an unknown location and identify two or more visible landmarks whose positions are known (e.g., mountain peaks, towers, or buildings).

(b) Use a compass to take a bearing of the first landmark.

(c) Record the bearing and repeat the process for the all chosen landmarks.

(d) Calculate the Back Bearings of all the chosen landmarks

(e) On a map, plot the back bearings from each landmark.

(f) The point where these lines intersect is your Own Position.

Challenge. Try this exercise with different combinations of landmarks and vary your position to see how the accuracy changes.

8. **Identifying Terrain Features for Inspection Mehthod**. Practice recognizing terrain features using a topographic map.

Steps.

(a) Select a topographic map of an area.

(b) Locate features like hills, valleys, ridges, saddles and depressions.

(c) Match these features with their contour patterns (e.g., concentric circles for hills, U- or V-shapes for valleys).

9. **Estimating Elevation**. Use contour lines to determine the elevation of specific points.

Steps:

(a) Identify a starting point and a target point on the map.

(b) Count the contour intervals between them.

(c) Add or subtract based on the direction of travel to estimate the elevation.

10. **Finding the Direction**. Determine bearings and directions using the map.

Steps:

(a) Orient the map using a compass.

(b) Select two points on the map.

(c) Draw a line connecting the points and measure the angle using a protractor or compass rose.

CONCLUSION

11. Back Bearing refers to the direction opposite to the forward bearing of a line or a course. It is used to determine the direction back to the starting point or reference line. Mastery of back bearings is essential for accurate and reliable navigation in both fieldwork and map reading. Resection is a map-reading technique used to determine one's exact position on a map by identifying known landmarks and measuring their bearings. The compass method is one of the most common ways to perform resection. Resection method is used in orienteering, military navigation, search and rescue operations and outdoor expeditions.

SUMMARY

- Back Bearing helps in retracing the path or determining the reverse direction to locate the starting point.
- It is calculated by adding or subtracting 180° from the forward bearing.
- Resection method with Compass allows the surveyor or hiker to pinpoint their location by triangulation.
- Resection method determines a person's position on a map by measuring bearings to known landmarks.
- The technique relies on visible landmarks and is especially useful when the exact position is unknown.
- Inspection Method is used to ensure the map and navigational tools are accurate and functioning properly during the journey.
- It prevents errors in navigation by allowing the user to confirm their route and position.
- Together, these methods aid in accurate navigation and position determination, especially in areas with little to no direct reference points.
- Each method has its advantages and specific uses depending on the navigation context and practical exercises are provided to help improve understanding and skills in using these techniques.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the back bearing of a direction if the forward bearing is 120°?

(a) 240° (b) 300° (c) 180° (d) 60°

Q2. A bearing of 270° corresponds to which back bearing?

(a) 90° (b) 180° (c) 360° (d) 270

Q3. A back bearing of 155° is given. What is the corresponding forward bearing?

(a) 35° (b) 175° (c) 335° (d) 315°

Q4. If a bearing of 180° is measured, what is the back bearing?

(a) 0° (b) 90° (c) 360° (d) 180°

Q5. What is the primary purpose of the resection method in map reading?

(a) To determine the direction of a map
(b) To locate the position of a point on a map
(c) To calculate distances between landmarks
(d) To find the contour of the terrain

Q6. In the resection method, which of the following tools is commonly used for determining the angle of the position?

(a) Compass (b) Protractor (c) Clinometer (d) Ruler

Q7. When performing resection, how many known points on the map are typically required for accurate positioning?

(a) One (b) Two (c) Three (d) Four

Q8. What is minimum angle between two reference points in resection method?

(a) 50^{o} (b) 20^{o} (c) 30^{o} (d) 25^{o}

Q9. The resection method is most effective with how many reference points?

(a) 02 (b) 01 (c) 03 (d) none of above

Q10. To use the Resection method effectively, you should:

(a) Align the map with the compass needle.
(b) Use a ruler to measure distances between landmarks.
(c) Identifying two objects as reference points on map and on ground.
(d) Measure angles to landmarks using a protractor.

Q11. What is the primary use of back bearings in navigation?

(a) To find the forward bearing
(b) To determine the opposite direction of a given bearing
(c) To identify landmarks
(d) To calculate distances between two points

Q12. Which of the following is a true statement about the relationship between forward bearing and back bearing?

(a) They are always the same direction
(b) The back bearing is 180° opposite to the forward bearing
(c) The forward bearing is always greater than the back bearing
(d) Back bearing is always calculated by adding 360°

Q13. How is the back bearing calculated when the forward bearing is less than 180°?

(a) Back bearing = Forward bearing - 180°
(b) Back bearing = Forward bearing + 180°
(c) Back bearing = Forward bearing x 2
(d) Back bearing = Forward bearing ÷ 2

Q14. In the resection method, which of the following steps is NOT involved?

(a) Taking bearings of landmarks from the current location
(b) Drawing lines of position based on the bearings
(c) Using a GPS device to track your position
(d) Identifying landmarks on a map

Q15. What is a major disadvantage of the inspection method in navigation?

(a) Requires a compass for precise directions
(b) It is time-consuming
(c) It is less accurate and dependent on visibility
(d) It requires multiple tools like a map, compass and protractor

Short Answer Questions

Q1. How do you calculate a back bearing If the forward bearing (FB) is less than 180°?

Q2. If your forward bearing is 135°, what is your back bearing?

Q3. If forward bearing to a mountain peak is 270°. What is the back bearing?

Q4. What are types of bearing?

Q5. What are advantages of inspection method?

Long Answer Questions

Q1. What is back bearing in map reading and explain with three examples?

Q2. What is the purpose of resection with compass method and explain the method to know own position by using this method.

Q3. What is inspection method and explain how it is carried out along with its purpose.

Q4. Describe Resection method of finding own position?

Q5. When to use inspection method?

MAP READING

CHAPTER MR-VIII - MAP TO GROUND AND GROUND TO MAP

"A good navigator can see the map in their mind, but the best navigators see the ground with their eyes and heart."

TEACHING INSTRUCTIONS

Period	**:**	**04 (160 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**2nd (02) & 3rd (02) year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Map Sheets, Compass, Service protractor, Pointer, Charts, Black board & Chalk.

Time Plan

- **Introduction : 10 Mins**
- **Part I : 30 Mins**
- **Part II : 30 Mins**
- **Conclusion : 10 Mins**
- **Practice : 80 Mins**

INTRODUCTION

1. Map reading is a fundamental skill for navigation, used by hikers, travellers, soldiers, surveyors and outdoor enthusiasts. It involves interpreting the symbols, scale and features of a map to understand the terrain and identifying your current location or a feature in the physical environment and finding its corresponding representation on the map. This chapter focuses on the two key processes in map reading: **Map to Ground and Ground to Map**. These techniques form the backbone of effective navigation and situational awareness. Together, these skills empower individuals to interpret landscapes, orient themselves confidently and make informed decisions in both familiar and unfamiliar environments. Mastering these concepts is crucial for ensuring safety, accuracy and efficiency in navigation.

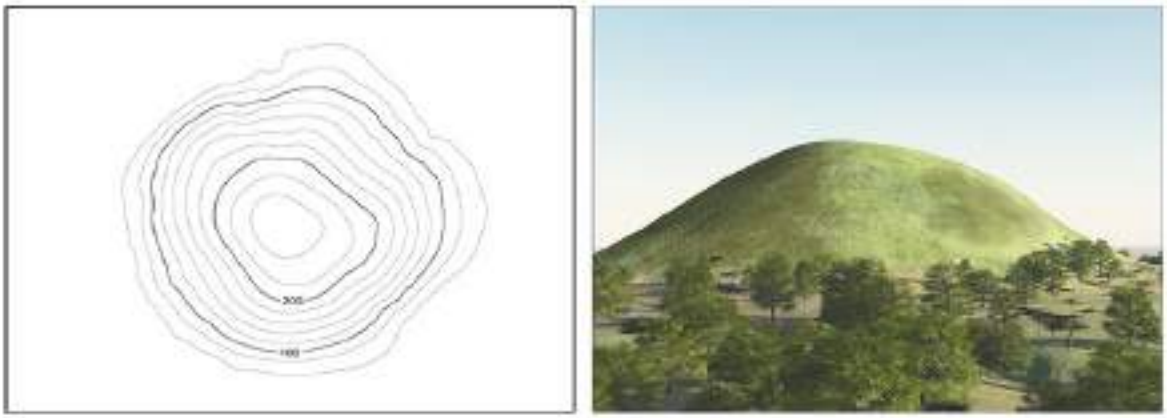
PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Map to ground** ➢ **Part II: Ground to map**	➢ **Learn to Identify features from ground to map** ➢ **Learn to identify objects from map to ground**

PART I: MAP TO GROUND

2. Map-to-ground is a skill to find out the details of features, landmarks, or terrain of the map on the ground in the real world. This process is essential for navigation, in outdoor activities such as hiking, orienteering and military operations. It helps in locating the exact position of objects on ground and on map. It also requires to judge distance. The essence of map reading training is to identify the objects and features on ground from a map and to identify the objects and features on the ground from the map.

3. Following methods are used to identify objects from map to ground:-

(a) **Bearing and Distance Method**. It is a fundamental technique in navigation used to determine or confirm a position on a map or in the field. This method involves taking a compass bearing from a known point to a visible landmark or feature and measuring the distance between the two points. The bearing provides the direction relative to the cardinal points, while the distance, often calculated using pacing, a measuring device, or map scales, allows for precise plotting on the map. By combining these two pieces of information, navigators can pinpoint their location, plan routes, or confirm their progress along a path. This method is particularly effective in areas with clear landmarks and is often supplemented with other navigation techniques for increased accuracy.



Map Contour seen on Ground

(b) **Direction and Distance Method**. In this method after setting of maps, draw a line on the map from own position to object to be identified on ground. Calculate distance and using any of the following methods find the direction of the object:-

(i) With the help of a sight rule find the ground direction of the object.

(ii) With the help of two points on the map estimate the ground direction.

(iii) Place a foot ruler /pencil at own position and align it with line of the map.

(iv) Place a pin each at the object and at the own position on the map. Align both pins and find general direction.

(c) **By Estimation Method**. The object is identified with the help of details around the object without measuring bearing, distance and direction by this method. The **estimation method in map-to-ground navigation** involves interpreting map information to predict or identify features in the terrain without needing precise tools. It's a useful technique for navigating efficiently when you need to relate features on a map to the real-world environment. Here are ways to apply estimation for **map-to-ground navigation**.

(i) **Map Orientation**. Use a compass to align the map with magnetic north, or match visible landmarks (e.g., a hill or lake) with their positions on the map to orient it. Once the map is oriented, estimate the direction of travel by visualizing a straight line between your position and the destination.

(ii) Using Linear Features. Identify roads, rivers, ridgelines, or trails on the map and locate them in the terrain. Use these as guides to stay oriented.

HOTS

- Plan and mark safe and easier route for hiking to the top of the hill from the base.

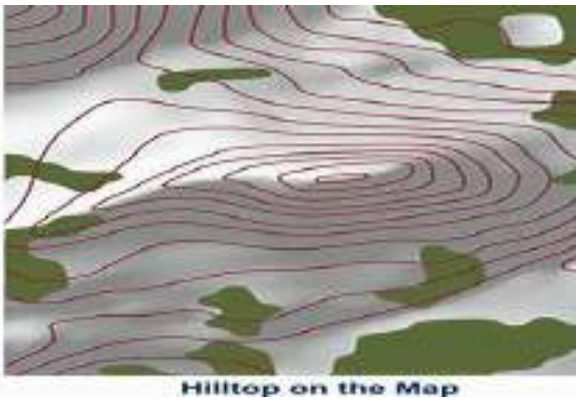
INTERESTING FACTS

- Linear features like rivers, trails, or roads can act as handrails to guide you while you navigate.
- Even without a compass, you can orient a map using the sun, stars, or simply by aligning with visible landmarks.
- When two paths or rivers cross, they are often marked distinctly on maps, making them reliable waypoints to confirm your position.

PART II: GROUND TO MAP

4. Ground-to-map navigation involves identifying your current location or features in the environment and then finding their corresponding positions on a map. This skill is essential for determining your position, planning your route, or verifying your progress in real-time. Ground-to-map complements map-to-ground navigation and ensures accurate situational awareness. To identify a ground object on the map is called ground to map. Methods to identify ground objects on map are:-


Hilltop on the Ground


Hilltop on the Map

(a) **Simple Method Using Bearing**. After Setting the map, find own position. Find out the magnetic bearing and the distance of the object. Convert magnetic bearing to grid bearing and plot grid bearing from own position by drawing a line. Mark the distance measured with service protractor on that line. The object on the map will be in proximity of the mark.

(b) **Intersection Method**. The intersection method is used to locate items that are farther away or in hilly terrain. In intersection method any object or place is identified by drawing line from two prominent feature of ground on map. Select minimum two prominent landmarks which can be easily identified on the ground. Read the bearing of object, we need to identify from two different places/ objects by compass. Convert the magnetic bearing in Grid bearing. Plot these two objects of ground on Map with help of GB and draw straight lines touching these two points. Find the object in the proximity of the intersection of the two lines.

(c) **By Direction Method**. After setting the map, find own position. Find the grid bearing of object on the map. Plot grid bearing on map and draw a line from own position in that direction. Mark the estimated distance of the object on the line. The object will be in the proximity of the marked point:

(i) Align own position with direction of object by placing a foot ruler /pencil at own position.
(ii) Place a pin at own position and second pin is placed in the direction of the object.
(iii) Mark the object on the map and find direction with the help of details around the object.
(iv) With the help of sight rule find exact direction of the object.

(d) **By Estimation Method**. An object can be located on map by knowing the magnetic bearing and distance of the object on ground. Observe features or distances on ground and estimate where they correspond on the map. This method is useful when trying to locate your position or confirm your route while moving in unfamiliar terrain. Here's a breakdown.

DID YOU KNOW?

- By aligning a map with visible landmarks (like rivers or mountains), you can navigate without tools.
- The sun’s position or shadows can also help determine directions in the absence of a compass

CONCLUSION

5. Map-to-ground and ground-to-map navigation are complementary techniques essential for successful navigation in outdoor and unfamiliar environments. Together, they enable individuals to effectively interpret maps, relate terrain features to map symbols and determine their position or path with confidence. Map-to-Ground navigation helps with planning routes, estimating distances and predicting terrain challenges using a map. This skill is critical for efficient movement and decision-making before and during travel. Ground-to-Map navigation is vital for confirming one's position, reorienting if lost and adapting plans based on the terrain. This technique ensures navigators can connect observed features in the environment back to the map. By mastering these skills, individuals can explore and operate in diverse environments, whether for recreational, professional, or emergency purposes, with reduced risk and greater efficiency.

SUMMARY

- Map-to-ground is an essential skill to find out the details of features, landmarks, or terrain of the map on the ground in the real world.
- Map to Ground is the essence of map reading training to enable the cadets to identify the objects and features on ground from a map and vice versa.
- Bearing and Distance Method, Direction and Distance Method and Estimation Method are used to identify objects from map to ground.
- Bearing and Distance Method is a fundamental technique in navigation used to determine or confirm a position on a map or in the field.
- Draw a line joining own position and object to be identified on the map in the Direction and Distance Method. Than measure distance between them and find the direction of the object.
- The estimation method involves interpreting map information to predict or identify features in the terrain without needing precise tools.
- To locate an object on the map that is indicated on the ground is called ground to map.
- Bearing, Intersection Method, Direction Method and Estimation Method are used to locate objects from ground to map.
- Ground-to-Map navigation is vital for confirming one's position, reorienting if lost and adapting plans based on the terrain.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What does the term "orientation" refer to on a map?

(a) The size of the map
(b) The alignment of the map with respect to the cardinal directions
(c) The symbols used on the map
(d) The scale of the map

Q2. Which of the following is not a primary cardinal direction?

(a) North (b) South (c) East (d) Northwest

Q3. Which of the following is used to measure distances on a map?

(a) Compass (b) Scale ruler (c) Protractor (d) Legend

Q4. What is the term used to describe the vertical distance between contour lines on a map?

(a) Elevation (b) Relief (c) Gradient (d) Slope

Q5. On a map, the scale is given as 1 cm = 5 km. If a river is 3 cm long on the map, what is the actual length of the river?

(a) 5 km (b) 10 km (c) 15 km (d) 20 km

Q6. What does the contour interval on a topographic map represent?

(a) The horizontal distance between two points
(b) The vertical distance between contour lines
(c) The depth of rivers
(d) The elevation of the highest peak

Q7. What does "map-to-ground" navigation involve?

(a) Locating your position on a map based on ground features
(b) Matching map symbols to real-world landmarks
(c) Identifying the scale of a map
(d) Using a compass to determine the cardinal directions

Q8. Which of the following is the most reliable feature for finding your position on a map?

(a) Contour lines
(b) Temporary landmarks (e.g., parked cars)
(c) Permanent landmarks (e.g., mountains, rivers, buildings)
(d) Grid lines

Q9. What does "Alignment of the map" mean?

(a) Turning the map so that north on the map aligns with true north on the ground
(b) Marking your current position on the map
(c) Calculating the distance to the next checkpoint
(d) Using the map to find a hidden trail

Q10. What is the purpose of using a resection method in map reading?

(a) To draw a new map.
(b) To identify your location on a map by triangulating from ground features.
(c) To plot a straight-line route on a map.
(d) To measure distances between two points.

Q11. What is the primary purpose of the Map-to-Ground navigation technique?

(a) To create new maps from the ground
(b) To identify features and landmarks on the ground based on a map
(c) To estimate distances between locations
(d) To convert magnetic bearings into grid bearings

Q12. Which method involves using a compass bearing and distance to locate a position on a map or in the field

(a) Direction and Distance Method
(b) Bearing and Distance Method
(c) Estimation Method
(d) Intersection Method

Q13. What does the "Direction and Distance Method" help to identify?

(a) The direction of a moving object
(b) The general direction and distance of an object
(c) The position of the map
(d) The exact location of an object based on latitude and longitude

Q14. Which of the following is NOT part of the "Direction and Distance Method"?

(a) Using a foot ruler to align with a line on the map
(b) Using a sight rule to find the ground direction of an object
(c) Calculating the exact elevation of an object
(d) Plotting grid bearings from known positions

Q15. What does the "Estimation Method" involve in Map-to-Ground navigation?

(a) Using precise tools to measure distances
(b) Estimating features in the terrain based on map information
(c) Drawing straight lines between two objects
(d) Measuring magnetic bearings to locate features

Short Answers Type Question

Q1. Explain Direction Method in finding object from Ground to Map

Q2. Define Estimation Method in Ground to Map?

Q3. What is the key feature of the "Intersection Method" in Ground-to-Map navigation?

Q4. In the "Simple Method Using Bearing," how is the object on the map located?

Q5. What is Intersection Method used to locate objects from ground to map?

Long Answers Type Questions

Q1. What are the methods of finding object from map to ground Explain in detail?

Q2. Explain the Direction and Distance Method in finding object from map to ground?

Q3. Explain Bearing and Distance method in finding object from map to ground.

Q4. What methods are used for Map-to-Ground?

Q5. What methods are used for Ground-to-Map?

MAP READING

CHAPTER MR-IX - NAVIGATION BY COMPASS

“Knowledge is the compass that guides us through the unknown.”

TEACHING INSTRUCTIONS

Period	**:**	**03 (120 Mins)**
Type	**:**	**Lecture/Practice**
Year	**:**	**1st (01),2nd (01) &3rd (01) Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Compass, Computer slides, Pointer, Charts, Blackboard & Chalk.

Time Plan

➢ **Introduction**	**:**	**05 mins**
➢ **Part I**	**:**	**20 mins**
➢ **Part II**	**:**	**10 mins**
➢ **Conclusion**	**:**	**05 mins**
➢ **Practice**	**:**	**80 mins**

INTRODUCTION

1. Compass navigation is a vital skill for traversing uncharted terrain, whether for exploration, military operations, or outdoor adventures. It combines the use of a magnetic compass with map reading and precise calculations to maintain direction, particularly in environments with limited visibility or scarce landmarks, such as dense forests, deserts, or during night time. Effective compass navigation involves understanding key concepts like bearings, magnetic variation and compass errors. Navigators must calculate grid bearings from maps, adjust for local variations to obtain magnetic bearings and account for compass errors to ensure precision. By following a structured procedure—setting the compass, aligning the magnetic needle and using landmarks or celestial references—individuals can navigate reliably. Team roles such as pacer, guide and recorder further enhance accuracy by measuring distances, maintaining course and documenting progress, making compass navigation a cornerstone of successful field navigation.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Navigation by Compass** ➢ **Part II: Composition of navigation party**.	➢ **Learn to Master Compass Navigation** ➢ **To understand team roles like pacer, guide and recorder for accurate navigation**. ➢ **Learn to apply navigation skills to diverse terrains and conditions**.

PART I: NAVIGATION BY COMPASS, CONCEPT OF PACER, GUIDE & RECORDER

2. **Navigation by Compass**. Navigation by compass is a critical skill in outdoor activities like trekking, military operations and orienteering. It involves determining and following a specified direction using a magnetic compass. This skill is particularly useful for maintaining a course over unfamiliar terrain during the day or night.

3. **Setting of Compass on Given Bearing**. Steps for setting bearing on a compass are as follows:-

(i) **Step 1**. Set the bearings of landmark on the compass to march.

(ii) **Step 2**. Place the compass on the palm of the left hand in such a way that the tongue notch is on the middle of the finger and the ring notch is straight to the wrist.

(iii) **Step 3**. Keep the left hand in the middle line of the belt in front of the body, then move it to the right or left accordingly so that the direction mark and the arrow mark come in a straight line.

(iv) **Step 4**. Now, by marching straight to the tongue notch, you will march on the bearings of the that landmark.

(v) **Step 5**. Regularly check the compass to stay on course, especially if terrain or obstacles require deviations.

Calculation of Grid Bearing

Grid bearing calculation is foundational for accurate navigation.

Example Calculation:

- Grid Bearing: 135°
- Local Variation: +5° (Magnetic north is east of grid north)
- Compass Error: -2°

Magnetic Bearing = 135° + 5° = 140°
Adjusted Magnetic Bearing = 140° - 2° = 138°

Set your compass to 138° and proceed.

4 **Procedure of Marching on a Compass Bearing**. Steps for marching on compass bearing during day and night are given below:-

(a) **During the day**. Steps for marching during day are as follows:-

(i) **Step 1**. **Determine the Destination** Identify the endpoint of your route on the map.

(ii) **Step 2**. **Calculate the Grid Bearing** Measure the angle between the grid north (vertical lines on the map) and the line pointing towards your destination using a protractor.

(iii) **Step 3**. **Convert Grid Bearing to Magnetic Bearing** Account for the local variation (difference between grid north and magnetic north, provided on the map legend).

(b) **Formula**. Magnetic Bearing=Grid Bearing ±Variation Add the variation if magnetic north is east of grid north. Subtract if it is west.

(i) **Step 4**. **Adjust for Compass Error** Compasses may have a built-in error or declination. Incorporate this into the magnetic bearing.

(ii) **Formula**. Adjusted Magnetic Bearing=Magnetic Bearing ±Compass Error

(iii) **Step 5**. **Set the Compass** Rotate the compass housing until the desired bearing aligns with the direction of travel arrow. Turn yourself until the magnetic needle aligns with the orienting arrow inside the compass housing.

(iv) **Step 6**. **Follow the Bearing** Identify a fixed point (e.g., a tree or rock) in your line of travel and walk towards it. Repeat as needed.

(v) **Step 7**. **Monitor Pacing** Use the concept of pacer (explained below) to measure distance accurately.

(c) **During the Night**. Follow the same steps as above but with modifications:-

(i) Use visible objects like stars, a flashlight beam, or reflective markers as reference points. Maintain frequent checks on your bearing to avoid deviation. Use a guide and recorder to support navigation (detailed below).

PART II: COMPOSITION OF NAVIGATION PARTY

6. **Composition of Navigation Party**. In any MR team there is a dedicated Pacer, Guide and Recorder. These roles are crucial for organized and accurate navigation, especially in a group.

(a) **Pacer**. Tracks the distance covered by counting steps. Knows the individual's average pace length (distance covered in one step). Calculates distance using the formula:

Distance Covered = Number of Steps × Pace Length

(b) **Guide**. Leads the group by following the compass bearing. Identifies intermediate landmarks and ensures the group remains on course.

(c) **Recorder**. Keeps a log of the bearings, distances and landmarks for reference. Acts as a backup for navigation data in case of errors.

6. **Tips for Effective Compass Navigation**. Some tips for effective compass navigation are given below:-

(a) **Practice Pacing**. Regularly measure and note your average pace length for accuracy in distance measurement.

(b) **Understand Local Variation**. Update your variation knowledge from recent maps or local sources.

(c) **Work as a Team**. Assign roles like pacer, guide and recorder to enhance efficiency and reduce errors.

(d) **Night Navigation**. Use luminous markers or reflective materials for better visibility and coordination.

HOT

- Analyse and evaluate the importance of accounting for local variation and compass error when navigating in unfamiliar terrain. How can errors in these calculations impact the overall accuracy of navigation?
- Given a scenario where a compass bearing is 90°, the local variation is -3° (magnetic north is west of grid north), and the compass error is 4° WEST, calculate the adjusted magnetic bearing. How would you ensure the team remains on course while navigating this bearing in a forested area?
- Design a strategy for a group trek at night, incorporating roles such as pacer, guide, and recorder, while considering challenges like reduced visibility and potential deviations from the planned route. How would teamwork enhance navigation efficiency in such conditions?

CONCLUSION

8. Navigation by compass is an essential skill that combines precision, planning and adaptability. By understanding the principles of bearings, accounting for variations and compass errors and mastering practical techniques for day and night navigation, individuals can confidently traverse diverse terrains. The roles of pacer, guide and recorder further enhance the accuracy and efficiency of navigation, fostering teamwork and reliability. Whether in challenging environments or routine expeditions, the ability to navigate effectively ensures not only safety but also a deeper connection with the art of exploration. With practice and knowledge, compass navigation remains a timeless and invaluable tool for adventurers and professionals alike.

SUMMARY

- Bearings and types of bearings, conversion of bearings
- Compass and Map Integration: Combine a magnetic compass with a map to determine and maintain a specific course, especially in challenging terrains.
- Grid to Magnetic Bearings: Calculate grid bearings from the map and convert them to magnetic bearings by accounting for local variation and compass errors.
- Precise Alignment: Set the compass to the calculated bearing and align the magnetic needle for accurate navigation.
- Night time Navigation: Use celestial objects, reflective markers, or artificial light to maintain direction in low-visibility conditions.
- Team Roles: Assign roles like pacer (measures distance), guide (follows bearing) and recorder (logs journey details) to enhance accuracy.
- Distance Measurement: Employ pacing to calculate distance by multiplying step counts with individual pace length.
- Adaptations for Conditions: Adjust navigation techniques for rugged terrain, low visibility, or dense vegetation.
- Landmark Guidance: Use visible landmarks to stay on course during daytime navigation.
- Practical and Continuous Practice: Master skills through consistent practice and real-world application to build confidence.
- Universal Utility: Apply compass navigation skills across diverse scenarios, benefiting adventurers, military personnel and outdoor enthusiasts.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of compass navigation?

(a) To find water sources in uncharted terrain
(b) To determine and follow a specific direction accurately
(c) To estimate the distance of travel in rough terrain
(d) To avoid the use of maps during navigation

Q2. What is the formula to calculate magnetic bearing?

(a) Magnetic Bearing = Grid Bearing × Variation
(b) Magnetic Bearing = Grid Bearing ± Variation
(c) Magnetic Bearing = Compass Error + Variation
(d) Magnetic Bearing = Grid Bearing ÷ Variation

Q3. What is the role of the pacer in compass navigation?

(a) Leading the group by following the compass bearing
(b) Measuring the distance travelled using step counts
(c) Recording bearings, distances and landmarks
(d) Identifying landmarks along the route

Q4. Which of the following steps is part of setting a compass?

(a) Using a protractor to calculate the bearing
(b) Adjusting for compass error on the map legend
(c) Aligning the magnetic needle with the orienting arrow
(d) Measuring the angular distance between cardinal directions

Q5. If the grid bearing is 120°, local variation is +3° and compass error is -2°, what is the adjusted magnetic bearing?

(a) 121° (b) 122° (c) 123° (d) 125°

Q6. Which of the following is NOT a step-in marching on a compass bearing?

(a) Determine the destination
(b) Adjust the compass to true north
(c) Identify and follow landmarks
(d) Monitor pacing regularly

Q7. What does a compass error of 2° EAST mean?

(a) The compass points 2° west of magnetic north
(b) The compass points 2° east of magnetic north
(c) The compass points 2° east of true north
(d) The compass is misaligned by 2° from grid north

Q8. What is the angular distance between cardinal and intermediate directions?

(a) 22.5° (b) 30° (c) 45° (d) 60°

Q9. Which role ensures documentation of bearings, distances and landmarks during navigation?

(a) Pacer (b) Guide (c) Recorder (d) Navigator

Q10. What is the primary adjustment made for night navigation?

(a) Avoid using reflective markers
(b) Use visible objects like stars or a flashlight as reference points
(c) Measure bearings using grid north instead of magnetic north
(d) Eliminate the need for compass error adjustment

Q11. Which of the following is a type of bearing based on North?

(a) Forward Bearing

(b) Backward Bearing

(c) True Bearing

(d) Object Bearing

Q12. What is a Grid Bearing?

(a) The angle between two objects measured from Magnetic North
(b) The angle between two objects measured from True North
(c) The angle between two objects measured from Grid North
(d) The angle between two objects measured from any random direction

Q13. Which of the following is true about Magnetic Bearings?

(a) Magnetic Bearings are based on True North
(b) Magnetic Bearings are based on Grid North
(c) Magnetic Bearings are based on Magnetic North
(d) Magnetic Bearings do not require any reference direction

Q14. What is the angle of convergence in bearing conversion?

(a) The difference between magnetic north and grid north
(b) The difference between true north and magnetic north
(c) The difference between true north and grid north
(d) The angular difference between two objects on the map

Q15. When converting a Grid Bearing to a True Bearing, if the angle of convergence is 2° east, what is the True Bearing?

(a) True Bearing is 2° less than Grid Bearing
(b) True Bearing is 2° more than Grid Bearing
(c) True Bearing remains the same as Grid Bearing

(d) True Bearing cannot be determined with this information

Short Answer Types Questions

Q1. What is the difference between grid north and magnetic north?

Q2. What is the role of a pacer in compass navigation?

Q3. Why is it important to adjust for compass error?

Q4. How is a Magnetic Bearing converted into a Grid Bearing when the magnetic north is west of grid north with a local variance of 1° west?

Q5. What should you do if obstacles cause deviations from the course when marching on a compass bearing?

Long Answer Types Questions

Q1. Explain the process of converting a grid bearing to a magnetic bearing, including how to account for local variation and compass error?

Q2. Describe the roles of pacer, guide and recorder in a navigation team and how they contribute to successful navigation?

Q3. How do navigation techniques differ during nighttime compared to daytime and what are the key challenges in night time navigation?

Q4. When converting a Grid Bearing to a True Bearing, if the angle of convergence is 2° east, what is the True Bearing?

Q5. Describe bearing and its types.

MAP READING

CHAPTER MR-X: PRACTICE OF MAP READING

"Maps are the mirrors of the world and map reading is the art of seeing through them to find your way"

TEACHING INSTRUCTIONS

Period	**:**	**04 (160 Mins)**
Type	**:**	**Practice**.
Year	**:**	**1st (01), 2nd (01) & 3rd (02) Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**.

Training Aids: Map with case, Compass, Writing material, Service Protractor and Pointer Staff.

Time Plan

- **General Guidelines of Doing Map Reading : 20 mins**
- **Practice on ground : 140 mins**

GENERAL GUIDELINES FOR DOING MAP READING

1. Map reading is a vital skill that allows individuals to navigate and interpret geographic locations, plan routes and understand the landscape. Whether you're hiking, traveling, or navigating urban environments, map reading provides a way to make sense of the terrain and find your way from one place to another.

2. **General Guidelines for Reading a Map**. Some general guide lines are for map reading are given below:-

(a) **Understand Map Features**. Familiarize with key map features like conventional symbols, scale (distance) and contour lines (elevation).

(b) **Setting of the Map**. Always orient the map so that the top corresponds to the true north or magnetic north. Use the compass for accurate orientation.

(c) **Identify Key Landmarks**. Look for prominent features such as rivers, roads, or peaks to identify your location or your route.

(d) **Use the Scale**. To measure distance, use the map scale and convert it to real-world distance (e.g., 1 cm on the map = 1 km in reality).

(e) **Use of Magnetic Compass**. Keep the compass level in hand to allow the magnetic needle to move freely. Point the compass in the direction object and then read the bearing from the compass housing. Bearings are measured in degrees from 0° to 360°, with north being 0°/360°, east 90°, south 180° and west 270°.

(f) **Follow the Bearing**. Keep the compass steady, aligning the magnetic needle with the orienting arrow as move towards the destination.

(g) **Reading Grid Bearing with Service Protractor**. for reading grid bearing between two objects, mark points with chinagraph pencil or by sketch on these objects. Draw a line joining these points and put the service protractor so the zero edge is over one of the point. Use the protractor to read the degree of the bearing.

(h) **Adjust for Declination (if necessary)**. If converting to magnetic bearings, adjust for the Grid convergence by adding or subtracting the declination value (found on the map).

(i) **For finding own position**. Find two or more landmarks that are visible and can be identified on the map.

(j) **Take Bearings to Each Landmark**. With your compass, take bearings from your location to each of the landmarks and calculate back bearing.

(k) **Plot Bearings**. Mark the back bearings on the map after converting to Grid bearing.

(l) **Determine Position**. The point where the lines of bearing intersect represents your location.

(m) **Map to ground**. Read the given Grid Reference (GR) on the map and determine its grid bearing relative to own position. Convert this grid bearing (GB) into a magnetic bearing (MB), then locate the corresponding object on the map in the direction of the magnetic bearing.

(n) **Ground to map**. Take MB of given object shown on the ground. Convert it into GB and plot on map from own position. Identify the object on line of this GB.

3. These steps will help you effectively navigate using both a magnetic compass and a service protractor for map reading and bearing measurements.

4. **Suggested charts for these exercises are as under**

(a) **Exercise chart for Own Position**

Ser No	Landmark name (Grid Reference)	Distance	Magnetic Bearing (MB)	Grid Bearing (GB)	Grid Back Bearing (GBB)	Own Position (GR)

(a) **Exercise chart for Map to Ground**

Ser No	Grid Reference (GR)	Grid Bearing (GB)	Magnetic Bearing (MB)	Distance	Name of landmark

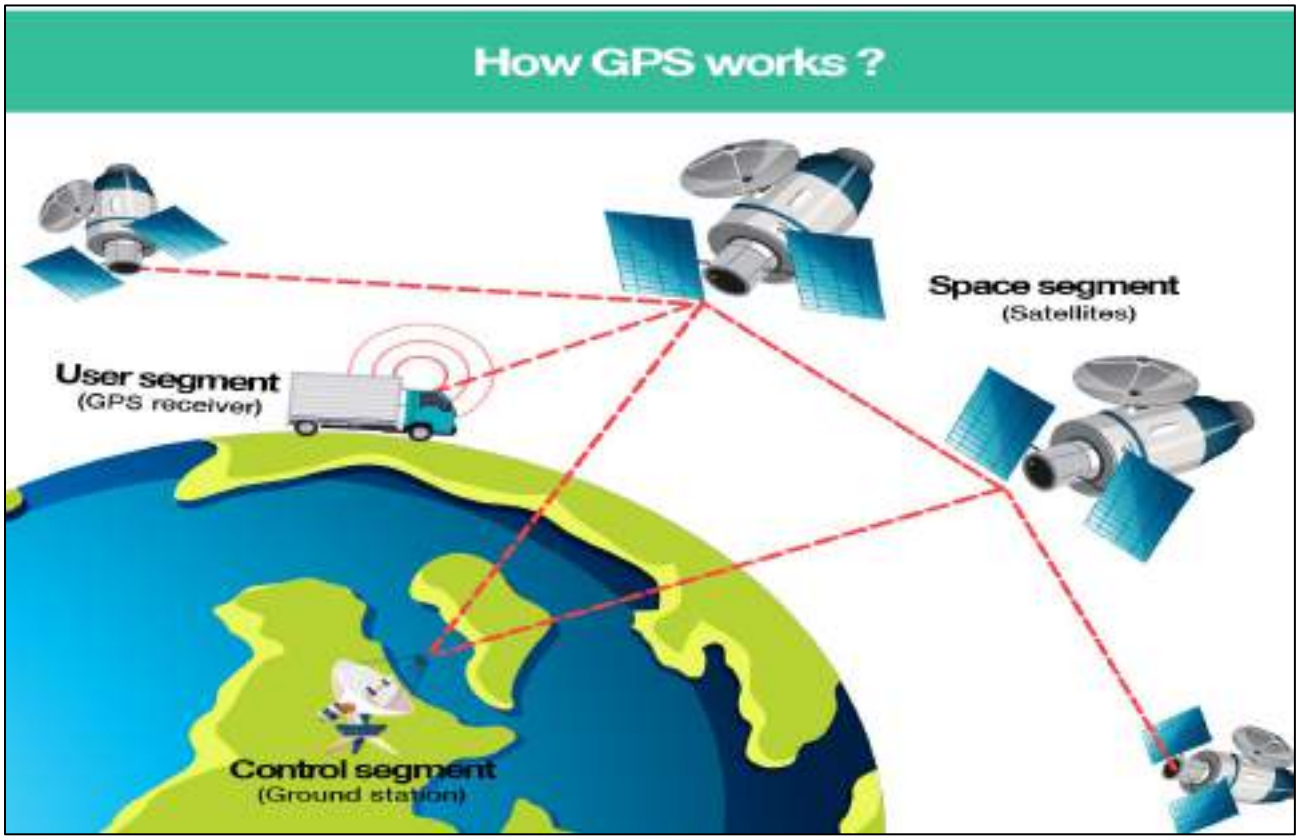
(c) **Exercise chart for Ground to Map**

Ser No	Landmark	Distance	Magnetic Bearing (MB)	Grid Bearing (GB)	GR

MAP READING

CHAPTER XI: GLOBAL POSITIONING SYSTEM

"Modern navigation isn't just finding a way—it's finding the best way."



TEACHING INSTRUCTIONS

Periods	**:**	**04 (160 Mins)**
Types	**:**	**Lecture & Practice**
Year	**:**	**1st (01),2nd(02) & 3rd (01) Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids:- OHP, Board Chalks & Marker

Time Plan:

- **Introduction : 05 Mins**
- **Part I : 30 Mins**
- **Part II : 25 Mins**
- **Part III : 25 Mins**
- **Part IV : 30 Mins**
- **Conclusion : 05 Mins**
- **Practice : 40 Mins**

INTRODUCTION

1. Global Positioning System (GPS) refers to the satellite-based navigation system by which the precise location of people and devices on the earth is pinpointed. Therefore Navigation, now has become very facile with the advent of GPS in the Armed forces as well as civil life worldwide. Global Positioning System was originally developed by the U.S. Department of Defence (DoD) in the 1970s for military purposes Modern technology has made the GPS receivers small portable, very handy, accurate and are also equipped in many vehicles which helps fishermen, drivers and hikers for navigation.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Global Positioning System** ➢ **Part II: Important features of GPS** ➢ **Part III: Map Reading and Navigation by GPS** ➢ **Part IV: Salient Aspects of Navigation by Compass**	➢ **Understanding about GPS** ➢ **To comprehend its functions and various features** ➢ **To understand Map Reading and Navigation with GPS** ➢ **To Learn about latest trends in GPS**

PART I: GLOBAL POSITIONING SYSTEM

2. Global Positioning System was originally developed by the U.S. Department of Defence (DoD) in the 1970s for military purposes, GPS has become essential for civilian applications worldwide.

3. **Satellite System Architecture**. The GPS architecture is divided into three major segments:-

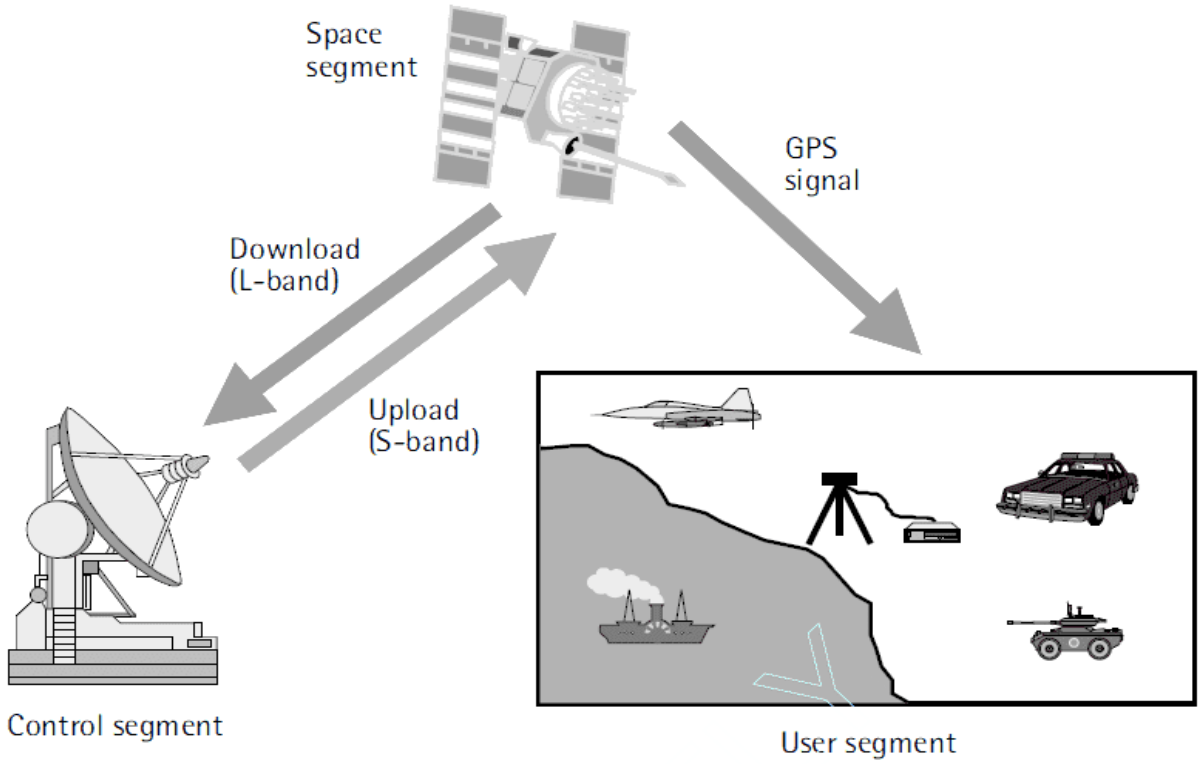
(a) **Space Segment**. Comprises a constellation of 24 to 32 satellites orbiting the Earth at an altitude of 20,200 km in six orbital planes. Each satellite completes an orbit in approximately 12 hours and is equipped with atomic clocks for accurate timing. Satellites continuously broadcast navigation signals containing Ephemeris data (precise satellite position) and Almanac data (general health and location of all satellites).

(b) **Control Segment**. A network of ground control stations responsible for monitoring, managing and updating satellites. It comprises of Master Control Station (MCS) that processes satellite data and ensures operational integrity, Monitor Stations to track satellite signals and relay data to the MCS and Ground Antennas to send updates (eg, corrections) to the satellites.

(c) **User Segment**. Includes any device with a GPS receiver, such as Smartphones, car navigation systems and drones (civilian use). Military vehicles, aircraft and personnel tracking systems. GPS receivers calculate position by triangulating signals from at least **four satellites** using the time delay of signals.

DID YOU KNOW?

- **Master Control Station**. Falcon Air Force base in Colorado, Colorado spring, America
- **Monitor Station**. Falcon Airforce base in Colorado, Cape Canaveral in Florida, Hawaii, Ascension island in Atlantic ocean - Diego Garcia island Indian ocean – Kwajalein island in Southern pacific ocean



Satellite System Architecture

4. **Usage of GPS**. GPS today has become indispensable in today's scenario and has diverse applications across industries, which include the following:-

(a) **Navigation**. GPS is primarily used for road, air and sea navigation for individuals and commercial transport. It is also used for guidance for autonomous vehicles.

(b) **Surveying and Mapping**. GPS is utilized for land surveying. Geographic Information Systems (GIS) for urban planning and resource management.

(c) **Agriculture**. GPS helps farmers with precision farming, allowing them to manage their land efficiently and optimize crop yields.

(d) **Military**. GPS helps in troop movement, target tracking, missile guidance and movement coordination.

(e) **Emergency and Disaster Management**. Locating survivors and coordinating relief efforts during natural disasters.

(f) **Geotagging**. GPS is used to add location data to photos, social media posts and videos, so people know where they were taken.

INTERESTING FACTS

- There are total 6 orbital planes with 4 space vehicles in each, that has equal space of 60° apart and inclined about 55° to the equatorial plane.
- Atomic clocks loose only one second in 3,00,000 years
- GPS is free worldwide however cost of maintaining the system is over $ 1 billion annually

PART II: IMPORTANT FEATURES OF GPS

5. **Key features of GPS**. Global Positioning System (GPS) Offers several critical features that make it indispensable for navigation, mapping and precise location determination. Below are the key features, including the specific ability to provide continuous own position and grid reference (GR) availability up to 10 figures:-

(a) **Global Coverage**. GPS works worldwide, providing location data regardless of where you are on Earth, whether in urban areas, remote regions, or at sea.

(b) **Real-Time Location**. GPS provides instant, real-time location information, helping users navigate and track their position continuously.

(c) **High Accuracy**. GPS offers high accuracy, typically within 5–10 meters, depending on conditions, allowing precise navigation and location tracking.

(d) **Grid Reference (GR) Availability (High-Precision Coordinates)**. GPS provides location data in various coordinate systems, including latitude/longitude and military-style Grid References (GR). A 10-figure GR provides accuracy up to 1 meter, ideal for military and precision tasks (e.g. 12345 67890). Civilian applications often rely on 6 to 8-figure GR, sufficient for general navigation and mapping.

(e) **Multi-Satellite Coverage**. At least four satellites are required to determine a 3D position (latitude, longitude and altitude) with precise time synchronization. Redundancy: With 24-32 satellites in orbit, the system ensures multiple satellites are visible at any location at any time, improving reliability.

(f) **Time Synchronization**. GPS provides highly accurate time data, synchronized to within nanoseconds, critical for financial systems, telecommunications and military operations.

(g) **Speed and Direction**. GPS can calculate speed which is useful for vehicles, aircraft and runners. It also indicates the direction of travel, crucial for navigation systems.

(h) **Dual-Use (Civilian and Military)**. Free access to basic GPS services for individuals and industries worldwide. Encrypted, higher-precision capabilities reserved for authorized military users, including anti-jamming and anti-spoofing protections.

HOT

- The local government is planning to develop a new community park in your city. Using Google Maps, students are tasked with identifying a suitable location, planning the layout, and evaluating the potential impact of the park on the community.

PART III: MAP READING AND NAVIGATION BY GPS

6. **Map Reading and Navigation by GPS**. The GPS method of map reading allows real-time tracking of your location on digital maps, showing nearby landmarks and routes. It eliminates the need for manual interpretation, offering turn-by-turn directions and automatically adjusting routes if you stray off course. This technology simplifies navigation by providing accurate, updated information instantly. Here's how working with GPS aids in navigation, including obstacle avoidance and route optimization:-

(a) **Turn on the Device**. Ensure the GPS is powered on and has a clear view of the sky to receive satellite signals.

(b) **Set Destination**. Input your destination or select it from pre-loaded maps.

(c) **Follow Directions**. The GPS provides step-by-step directions for reaching your destination, which may include turn-by-turn navigation.

(d) **Monitor Position**. GPS updates your position in real-time, showing your movement and recalculating routes if necessary.

DO YOU KNOW?

- GPS devices are used for a wide range of applications, including navigation, mapping, surveying, and tracking

7. **Working with a GPS**. Working with GPS is explained as under:-

(a) **Route Distance and Time Planning**. GPS offers pre-calculated routes to destinations based on various parameters, such as shortest distance, fastest time and preferred terrain (e.g. avoiding steep gradients or rough roads). Digital maps and navigation software uses topographic data to suggest routes with manageable slopes or gradients, making travel easier. Time Planning to arrive at the destination (ETA) is based on the speed, route and traffic data for vehicles, apps like Google Maps or Waze use live traffic information to refine time estimates.

(b) **Waypoints**. A **waypoint** is a specific location or coordinate that you mark or save for navigation. Waypoints are essential for multi-stage navigation, hiking, or exploring unfamiliar areas. A waypoint can represent landmarks, checkpoints, or points of interest. Waypoints can be marked using latitude/longitude, or Grid References.

(c) **Feeding/Entering Waypoints**. Feeding waypoints into a Garmin GPS device is a fundamental skill for navigation, especially in field exercises. Here's a step-by-step guide to inputting waypoints into most Garmin GPS devices:-

(i) Turn on Garmin GPS unit by pressing the **Power button** (usually located on the side or top).

(ii) On most Garmin devices, press the "Mark" or "Menu" button (depending on your model).

(iii) Select "Waypoints" or "Create New Waypoint" from the available options.

(iv) To name a waypoint usually a short code or reference, like "WP1" or "Check Point A." Some models allow for more detailed names, while others limit characters.

(v) After naming the waypoint, the next screen will allow to enter the latitude and longitude of the waypoint.

(vi) Garmin typically uses degrees, minutes and seconds (DMS) or decimal degrees (DD). Enter the coordinates accurately, following the format required by GPS device.

(vii) Coordinates can be entered manually or use the device's map to move a cursor to the marked location. Once the coordinates are entered and any other necessary information, press "Save" or "Enter" to save the waypoint to your GPS.

- To input multiple waypoints, repeat the process for each one. Many Garmin GPS devices allow to store hundreds of waypoints.
- To navigate to a waypoint, go to the **"Waypoints"** list, select one and then choose **"Navigate"**. This will provide directions on how to reach the waypoint.

(d) **Navigating Between Waypoints**. Point-to-point navigation follows a straight or optimal route between two waypoints. Waypoint Sequencing helps plan multi-stage routes by arranging waypoints in order. Visual and auditory cues guide users to each waypoint, displaying the distance, direction and estimated time to reach it.

(e) **Track Back Features**. The Track Back feature (also called Backtrack) helps users retrace their path to the starting point, essential in scenarios like getting lost or returning along the same route. Track Back feature works as GPS continuously records your trail as you move, storing it as a track log. While retracing steps the Track Back feature uses this recorded track log to guide you back along the same path displaying turn-by-turn directions, showing the exact route, you took.

8. **Uses of GPS in the Army**. The Global Positioning System plays a critical role in modern military operations, offering real-time positioning, navigation and timing data that enhance the precision, efficiency and effectiveness of various tasks. Here's how GPS is specifically used in the Army, with a focus on its application in artillery fire direction:-

(a) **Precise Targeting**. GPS allows artillery units to calculate exact target coordinates, improving the accuracy of their fire. Forward observers with GPS devices can relay precise positions of enemy targets, minimizing collateral damage.

(b) **Fire Control Systems**. Modern artillery systems use GPS to automate calculations of azimuth, elevation and range to target. This reduces errors from manual calculations and environmental factors, ensuring accurate targeting.

(c) **Movement and Positioning of Artillery**. GPS helps artillery units position themselves accurately, enabling quick setup and precise fire. Mobile artillery can reposition without losing targeting accuracy, offering enhanced operational flexibility.

(d) **Navigation and Movement**. GPS assists soldiers in navigating unfamiliar terrain, reducing reliance on traditional methods. It also helps military vehicles follow optimized routes, avoiding hazards and improving convoy coordination.

(e) **Reconnaissance and Surveillance**. GPS provides accurate geolocation data for reconnaissance, helping map enemy positions. It coordinates drones and reconnaissance teams, ensuring effective surveillance and targeting.

(f) **Logistics and Supply Chain Management**. GPS tracks military supplies, ammunition and personnel, reducing delays and preventing losses. It enables automated monitoring of supply convoys, ensuring efficient and timely delivery.

PART IV: MODERNS TRENDS IN GPS

9. **Modern Trends in GPS Technology**. GPS devices are now integrated with other GPS technology has expanded beyond navigation and military uses, integrating with other technologies for fitness, weather tracking, communication and more.

(a) **GPS and Radio Set Combos**. GPS-radio combos enable simultaneous navigation and communication, improving troop coordination and reducing friendly fire risks.

(b) **Smartphone Compatibility**. Modern GPS devices sync with smartphones, enhancing apps like Google Maps and Strava for real-time navigation, fitness tracking and route planning.

(c) **Integration with Active Weather Forecasting**. Many GPS devices now include real-time weather updates and barometric altimeters, providing essential weather data for outdoor activities and military operations.

(d) **Fitness and Health Monitoring**. GPS devices paired with fitness trackers monitor activity, track calories burned and provide heart rate data for more accurate health and workout insights.

(e) **Calorie-Burnt and Heart-Rate Monitors**. GPS technology in fitness trackers tracks movement, speed and elevation to monitor calorie burn and heart rate. Many devices also include optical sensors or chest strap compatibility for accurate heart rate data, providing insights into workout intensity and recovery.

10. **Advantages of GPS**. The advantages of GPS are given below:-

(a) **High Accuracy**. Provides precise location information, often within 5-10 meters.

(b) **Global Coverage**. Works worldwide, even in remote or difficult terrains.

(c) **Ease of Use**. Simple to operate, with automatic route calculation.

(d) **Real-Time Navigation**. Provides real-time directions and distance calculations.

(e) **Time Synchronization**. Offers accurate time for various industries.

(f) **Humanitarian Assistance and Disaster Relief (HADR)**. Enhances safety by aiding in rescue operations and monitoring.

11. **Disadvantages of GPS**. The disadvantages are given below:-

(a) **Signal Dependency**. Accuracy can be affected by weather, obstructions, or signal loss in certain areas.

(b) **Vulnerable to Jamming**. GPS signals can be jammed or hacked, disrupting functionality.

(c) **Privacy Concerns**. GPS can be used for tracking, raising potential privacy issues.

(d) **Over-Reliance on Technology**. Excessive use can lead to a decline in traditional navigation skills.

(e) **Cost of High-End Devices**. Specialized GPS units can be expensive.

CONCLUSION

12. The Global Positioning System (GPS) has evolved from a military tool to a crucial technology used in various industries like navigation, agriculture and emergency response. With its global coverage and high accuracy, GPS supports precise tasks such as surveying, military operations and logistics. Modern advancements, including integration with smartphones, wearables and weather forecasting, continue to expand its functionality, making it indispensable in daily life and specialized fields. These developments ensure GPS remains a vital tool in shaping the future of navigation and connectivity.

INTERESTING FACTS

- GPS was originally developed by the U.S. Department of Defence for military navigation. It became available for civilian use in the 1980s.
- GPS works anywhere in the world, 24/7, and in all weather conditions, thanks to a constellation of at least 24 satellites orbiting Earth.
- GPS relies on extremely accurate atomic clocks on each satellite, which provide precise timing down to a billionth of a second. This precision is crucial for accurate positioning.
- GPS technology helps monitor tectonic movements and can detect shifts in the Earth's crust caused by earthquakes, aiding in early warning systems.

SUMMARY

- Global Positioning System (GPS) is developed by the U.S. Department of Defence in the 1970s, initially for military use, GPS is now crucial for civilian applications globally.
- Satellite System Architecture consists of Space Segment**,** Control Segment, User Segment
- GPS is used in Navigation**,** Surveying & Mapping, Agriculture**,** Military, Emergency & Disaster Management, Time Synchronization**,** Scientific Research**,** Alternative Systems.
- Important Features of GPS are Continuous Position Tracking, Grid Reference (GR), Global Coverage, High Accuracy, Ulti-Satellite Coverage, Time Synchronization.
- **Real-Time Positioning**: GPS overlays the user's location on a digital map, updating in real time.
- **Waypoints**: Users can mark specific locations (coordinates or grid references) for navigation. This is useful for multi-stage travel or exploration.
- **Track Back**: Allows users to retrace their steps by following a recorded trail, providing safety if lost.
- **Artillery Fire Direction**: GPS enables precise targeting and coordination of artillery fire, minimizing collateral damage.
- GPS technology in fitness trackers tracks movement, speed and elevation to monitor calorie burn and heart rate.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. Which GPS feature allows users to save their current position for later use?

(a) Waypoint marking (c) Satellite mapping
(b) Geo fencing (d) Rerouting

Q2. What type of coordinates does GPS provide to determine a location?

(a) Elevation and temperature (b) Latitude and longitude
(c) Distance and speed (d) Altitude and velocity

Q3. Why might your GPS device show an inaccurate position?

(a) Low battery on the device
(b) Poor satellite visibility due to tall buildings or trees
(c) Using it while stationary
(d) Overheating of the receiver

Q4. How does a GPS receiver determine its position?

(a) By using signals from at least three satellites
(b) By analysing weather conditions
(c) By connecting to Wi-Fi hotspots
(d) By measuring the speed of travel

Q5. Which feature of GPS helps to measure the distance between two points?

(a) Route optimization (c) Geo fencing
(b) Ranging (d) Real-time tracking

Q6. Which of the following is not a typical application of GPS?

(a) Navigation for vehicles (b) Tracking the location of smartphones
(c) Sending and receiving text messages (d) Mapping and surveying

Q7. How does the army use GPS for precision strikes?

(a) By determining the exact location of enemy targets
(b) By guiding soldiers through maps
(c) By transmitting radio signals to bases
(d) By scanning the environment for weather data

Q8. What is the primary use of waypoints in GPS navigation?

(a) To calculate the speed of travel
(b) To mark specific locations for reference or navigation
(c) To determine the weather conditions
(d) To display live traffic updates

Q9. Which GPS feature is most helpful for planning a route with multiple stops?

(a) Waypoints (b) Trackback (c) Satellite imagery (d) Geo fencing

Q10. How does a GPS calculate the time required to reach a destination?

(a) By estimating the traveller’s energy level
(b) By using the average speed and distance to the destination
(c) By analysing weather conditions
(d) By measuring elevation changes

Q11. What does the "trackback" feature in GPS do?

(a) It allows users to retrace their route back to the starting point.
(b) It creates alternate routes based on traffic conditions.
(c) It marks the shortest distance between two points.
(d) It provides real-time feedback on nearby waypoints.

Q12. How does GPS enhance artillery targeting in the Army?

(a) It helps calculate the exact position of enemy targets.
(b) It automates calculations of azimuth, elevation and range.
(c) It helps position artillery units quickly and accurately.
(d) All of the above.

Q13. What does the GPS control segment primarily do?

(a) It tracks the user’s position.
(b) It manages the satellites and sends updates.
(c) It ensures the satellites’ power supply.
(d) It receives signals from GPS devices.

Q14. What is one major benefit of GPS compatibility with smartphones?

(a) It enhances battery life of smartphones.
(b) It improves apps like Google Maps for navigation and fitness tracking.
(c) It eliminates the need for GPS devices.
(d) It provides weather updates only.

Q15. How does GPS technology help with fitness tracking?

(a) It tracks location and elevation for calorie burn and heart rate.
(b) It prevents data loss in fitness apps.
(c) It synchronizes all workout data to the cloud.
(d) It provides automatic weather alerts during exercise.

Short Answers Types Questions

Q1. What are the uses of GPS in the Army?

Q2. What are waypoints and why are they essential for navigation?

Q3. What is the backtrack feature in GPS?

Q4. What are the latest trends in GPS?

Q5. How does GPS assist military operations?

Long Answer Types Questions

Q1. Explain Satellite System of Architecture?

Q2. What are the uses of GPS?

Q3. What are the advantages and limitations of GPS?

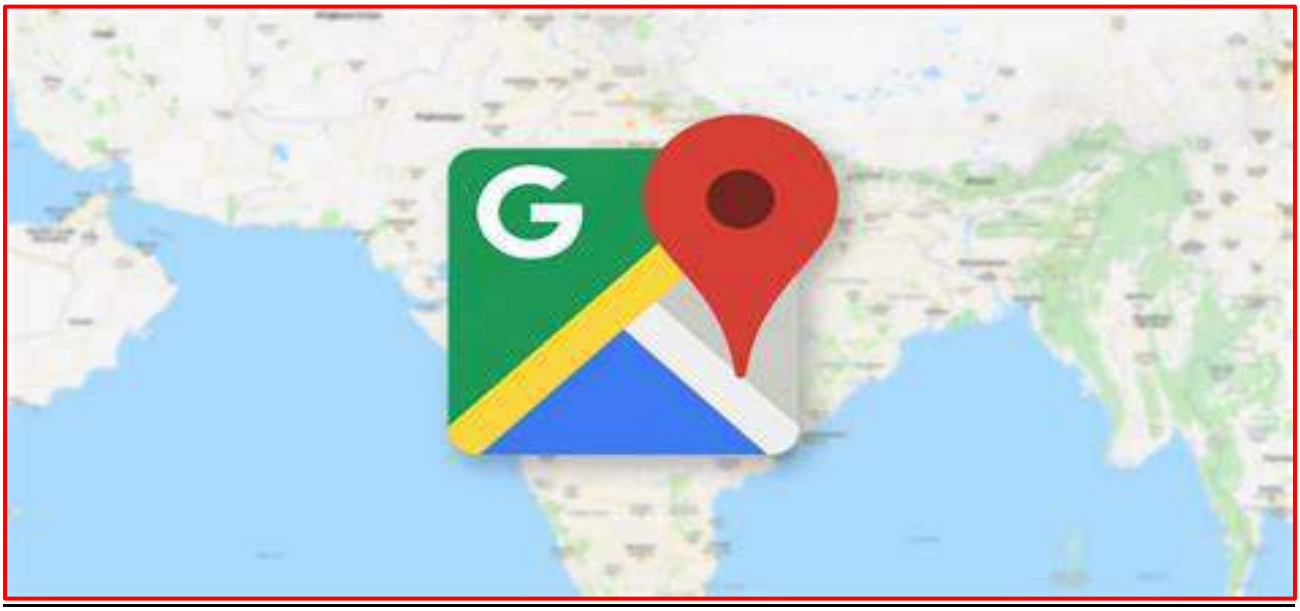
Q4. What are the important features of GPS?

Q5. How GPS aids in navigation including obstacle avoidance and route optimization?

MAP READING

CHAPTER MR-XII: GOOGLE MAPS AND OTHER APPLICATIONS

"Google Maps is more than just directions; it's a window into the world around us."



TEACHING INSTRUCTIONS

Periods	**:**	**04 (160 Mins)**
Type	**:**	**Lecture & Practice**
Year	**:**	**1st(01), 2nd (01) & 3rd (02) Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Smart Phones, Classrooms, OHP, Board Chalks & Marker

Time Plan

- **Introduction : 05 Mins**
- **Part I : 15 Mins**
- **Part II : 20 Mins**
- **Part III : 20 Mins**
- **Practice (3 years) : 80 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. Google Maps is a web-based mapping platform developed by Google, providing users with access to a wide range of geographic and navigational tools. First launched in 2005, it has since become a comprehensive tool for mapping, navigation and real-time updates. It combines advanced technology like satellite imagery, aerial photography and real-time traffic data to deliver a user-friendly experience on smartphones, tablets and desktops. Google Maps are widely used for navigation (driving, walking, cycling and public transit).

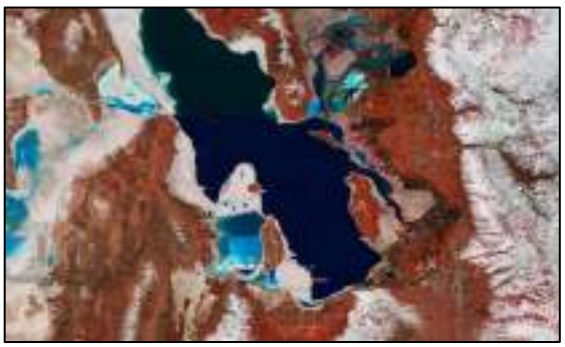
PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Introduction and Main features of Google Maps** ➢ **Part II: Applications of Googles Maps** ➢ **Part III - Navigation by Google Map** ➢ **Part IV - Other Applications for Navigation**	➢ **To understand about Google Maps and its various functions**. ➢ **To comprehend the uses of Googles Maps, its features** ➢ **To learn navigation by Google Map**

PART I – INTRODUCTION AND MAIN FEATURES OF GOOGLE MAPS

2. **Google Maps**. is a web-based mapping platform developed by Google, providing users with access to a wide range of geographic and navigational tools.

3. **Main Features of Google Maps**. The main features of google maps are given below:-

(a) **Satellite Imagery**. Google Maps provides detailed and high-resolution satellite images of nearly every corner of the Earth. Google Maps gives out Terrain Mapping Including topographic views of landscapes, helping users understand natural features like mountains, rivers and forests. Which is very useful for geographic studies, urban planning and visual exploration of remote areas.



(b) **Aerial Photography**. Aerial photography gives Bird's-Eye views and offers aerial perspectives that allow users to see landscapes and city layouts from above. This feature helps in real estate planning, tourism and location scouting. This is often combined with satellite imagery to provide a seamless experience.

(c) **Street Maps**. Streets Maps gives out detailed road networks including streets, highways, lanes and footpaths. It provides landmark-based navigation which displays key landmarks, businesses, parks, schools and points of interest. Search ability allows users to search for specific addresses, nearby locations and custom queries.

(d) **Panoramic Street View**. 360-degree Imagery provides a ground-level view of streets and landmarks, enabling users to "walk" through areas virtually. Interior views of some businesses and public venues (e.g., museums, restaurants) offer interior Street View tours. This feature provides accessibility and enables users to preview destinations, plan routes and explore unfamiliar areas visually.

Real time Traffic Condition reflected on the Google map

(e) **Real-Time Traffic Conditions**. Traffic Flow Visualization displays road congestion with color-coded overlays (green for smooth flow, red for heavy traffic). Alternate route suggestions are given out dynamically adjusts routes based on traffic conditions to save time.

(f) **Navigation and Directions**. Turn-by-turn guidance for driving, walking, cycling, or using public transport. Multiple route options based on travel preferences (fastest, shortest, avoiding tolls). Downloadable maps allow navigation without an internet connection, ideal for remote areas. This feature helps the user navigate in rural areas.

INTERESTING FACTS

- Google Maps has over 1 billion active users each month, making it one of Google's most popular services.
- It can explore maps of the **Moon** and **Mars** through its platform.
- It provides coverage for over 220 countries and territories**,** reaching approximately 99% of the world's population. It is available in more than **80 languages**, making it accessible to people worldwide

PART II: APPLICATIONS OF GOOGLES MAPS

4. **Applications of Google Map**. Some applications of Google maps are given below:

(a) **Travel and Navigation**. Google Maps offers detailed navigation, real-time updates and route suggestions for driving, walking, cycling and public transportation, ensuring smooth travel experiences.

(b) **Voice Navigation**. Turn-by-turn voice instructions in multiple languages make driving and walking navigation hands-free and safer, especially when focusing on the road.

(c) **Tourism and Exploration**. Google Maps helps users discover new places, offering reviews, Street View, 3D imagery and offline maps for trip planning and exploration.

(d) **Urban Planning**. Google Maps supports urban planning by visualizing geographical data, infrastructure and land use, aiding the design and optimization of urban developments.

(e) **Business Search**. Google Maps aids businesses by providing optimized routing, fleet management and seamless integration with Google services for delivery, real estate and logistics.

PART III: NAVIGATION BY GOOGLE MAP

5. **Navigation by Google Map**. Google Maps is an essential tool for transit navigation, offering features that make traveling easier, faster and more efficient. Some of the uses of Google Maps in direction finding are as under:-

(a) **Real-Time Navigation**. Google Maps is an essential tool for finding directions during transit, whether traveling by car, bike, public transport, or on foot. The app updates directions dynamically, helping travellers adjust their routes based on real-time conditions.

(b) **Traffic Monitoring**. One of the most valuable features of Google Maps is its real-time traffic updates, which indicate congestion, accidents, or road closures along the route. It uses live data to provide alternate routes, helping users avoid delays and reach their destination more efficiently.

(c) **Offline Navigation**. Users can download maps for offline use, ensuring uninterrupted navigation in areas with poor or no internet connectivity. This is particularly useful for road trips or traveling in remote locations

(d) **Multi-Stop Routes**. Google Maps allows users to add multiple stops to their journey, making it easier to plan trips that involve visiting several locations. This is especially helpful for delivery drivers or those running errands.

(e) **Location Sharing**. With live location sharing, Google Maps enables users to share their real-time location with others. This feature is useful for coordinating meet-ups or ensuring safety during travel.

6. **Advantages of Google Maps**. The advantages of Google maps are as under:-

(a) **Real-time Traffic Updates**. Provides live traffic information, helping users avoid congested routes.

(b) **Turn-by-turn Navigation**. Offers step-by-step directions for driving, walking, cycling and public transportation.

(c) **Multi-mode Navigation**. Supports multiple modes of travel (car, public transport, walking, cycling).

(d) **Offline Maps**. Users can download maps for offline use in areas with no internet connection.

(e) **Business Listings**. Provides information about local businesses, reviews, hours and contact details.

7. **Disadvantages of Google Maps**. The disadvantages are given below:-

(a) **Dependence on Internet**. Requires an active internet connection for real-time updates and full functionality.

(b) **Battery Drain**. Continuous use of GPS and real-time navigation can consume significant battery power.

(c) **Accuracy Issues**. Can occasionally provide incorrect directions or out-of-date information, especially in remote areas.

(d) **Data Usage**. Using Google Maps frequently can lead to high data consumption, particularly for navigation and updates.

(e) **Over-reliance on GPS**. Users may become too dependent on navigation, potentially lacking basic map-reading skills.

PART IV: OTHER APPLICATIONS FOR NAVIGATION

8. **Other Applications for Navigation**

(a) **NavIC (Navigation with Indian Constellation)**. NavIC (Navigation with Indian Constellation) is an indigenous satellite navigation system developed by India and it serves as an alternative to other global positioning systems (GPS). It is designed

to provide accurate positioning (range of 5 meters) and timing information, especially for India and the surrounding region. NavIC is integrated into India's defence systems, providing secure, accurate navigation for military applications, including troop movements and missile guidance.

(b) **Mappls (Map Location and Place Search)**. Mappls is a comprehensive mapping and navigation app developed by **MapmyIndia**, offering accurate and reliable digital maps for India. The app provides real-time navigation, traffic updates, route planning and location search features for users traveling by car, bike, or on foot.

(c) **Waze**. It is a popular navigation app known for its community-driven features, where users share real-time information about traffic, road conditions, accidents and hazards. Waze was developed by an Israeli company and later acquired by Google in 2013.

9. **Introduction to Google Earth**. Google earth is a virtual mapping service that allows users to explore satellite imagery, maps, terrain and 3D buildings of various locations around the world. It provides a detailed, interactive platform for viewing geographic data and can be used for navigation, education and planning. Google Earth allows users to zoom in on any area, explore street views and even access historical imagery. It's available as a desktop application and online, offering both casual users and professionals a powerful tool for geographic exploration.

HOT

- Use Google Earth to explore and compare satellite images of a specific area from different years to identify significant environmental changes.
- What noticeable changes can you observe in the landscape over the past decade? (e.g., deforestation, urban expansion, changes in water bodies)
- How have these changes impacted the local environment and ecosystem?
- What patterns can be identified in the progression of these changes?

CONCLUSION

10. Google Maps is a versatile and essential tool that has revolutionized navigation and geographic exploration since its inception. With features like satellite imagery, real-time traffic updates and street-level panoramic views, it enhances the travel experience by offering accurate, up-to-date and customizable route guidance for various modes of transport. Its broad applications in tourism, business, urban planning and real-time navigation make it indispensable for users globally, ensuring convenience and efficiency in daily travel and exploration. Other apps like NavIC focusing on regional accuracy and security, Mappls providing reliable mapping for India and Waze offering community-driven traffic updates. Together, they enhance the overall navigation experience across different platforms and regions.

SUMMARY

- Google Maps is a web-based mapping and navigation platform that provides detailed geographic information and real-time services to users worldwide.
- Features of Google Maps are Satellite View, Aerial Photography, Street Maps, Panoramic Street View
- Google Maps provides detailed and high-resolution satellite images of nearly every corner of the Earth.
- Real Time Traffic Condition Google Maps is an essential tool for transit navigation, offering features that make traveling easier, faster and more efficient.
- Google maps also guide travellers during transit by providing Real-Time Navigation, Route Planning, Public Transit Support, integration with Ridesharing Apps
- Google Maps is an essential tool for transit navigation, offering features that make traveling easier, faster and more efficient.
- NavIC is designed to provide accurate positioning (range of 5 meters) and timing information, especially for India and the surrounding region
- Mappls is a comprehensive mapping and navigation app developed by Map my India.

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of Google Maps?

(a) Social media networking
(b) Navigation and location services
(c) File sharing
(d) Online shopping

Q2. What is the primary function of NavIC (Navigation with Indian Constellation)?

(a) To provide global positioning services
(b) To provide navigation and timing information specifically for India and nearby regions
(c) To offer real-time traffic updates for India
(d) To create digital maps for India

Q3. What is the purpose of Google Maps' "Street View"?

(a) To display 3D images of a location
(b) To view panoramic, ground-level images of streets and locations
(c) To measure distances between two points
(d) To save offline maps

Q4. Which of the following is required to save a Google Map for offline use?

(a) Internet connection
(b) Google Maps Premium subscription
(c) Download the map area in advance
(d) GPS tracking

Q5. Which feature is offered by the Mappls app?

(a) Satellite-based navigation for military applications
(b) Real-time navigation, traffic updates and route planning for India
(c) Community-driven traffic updates
(d) Global positioning services for worldwide use

Q6. Which of the following features helps calculate the fastest route to a destination?

(a) Compass Mode
(b) Directions and Navigation
(c) Street View
(d) Location Sharing

Q7. What is a unique characteristic of Waze compared to other navigation apps?

(a) It is designed only for military applications
(b) It offers real-time community-driven information about traffic and road conditions
(c) It provides navigation only for pedestrians
(d) It was developed by the Indian government

Q8. How can a user share their real-time location on Google Maps?

(a) By enabling Traffic Layer
(b) By using Location Sharing feature
(c) By saving the map offline
(d) By turning on Satellite View

Q9. Which feature of Google Maps helps users understand the natural features of landscapes like mountains and rivers?

(a) Aerial Photography
(b) Terrain Mapping
(c) Real-Time Traffic Conditions
(d) Panoramic Street View

Q10. What type of imagery provides detailed views of Earth's surface from above?

(a) Panoramic Street View (b) Aerial Photography

(c) Satellite Imagery (d) Street Maps

Q11. Which feature provides a ground-level view of streets, allowing users to "walk" through areas virtually?

(a) Street Maps
(b) Panoramic Street View
(c) Real-Time Traffic Conditions
(d) Aerial Photography

Q12. How does Google Maps display real-time traffic conditions?

(a) By showing satellite images
(b) Using color-coded overlays
(c) By listing street names
(d) By showing historical data

Q13. Which of the following navigation modes is NOT supported by Google Maps?

(a) Walking
(b) Cycling
(c) Air travel
(d) Driving

Q14. Which feature allows users to explore new places by searching for nearby restaurants, hotels and parks?

(a) Real-Time Traffic Conditions
(b) Business Search
(c) Tourism and Exploration
(d) Street Maps

Q15. What is the key use of Google Maps in urban planning?

(a) Advertising new businesses
(b) Analysing geographical data and infrastructure
(c) Tracking social media activity
(d) Monitoring stock prices

Short Answers Type Question

Q1. Explain the features of Satellite view and Street View on Google map?

Q2. Which Google Maps feature helps businesses with optimized routing and fleet management?

Q3. What feature of Google Maps is useful for navigation in areas with poor or no internet connectivity?

Q4. What are Real-time updates?

Q5. How does Google Maps help users during real-time navigation?

Long Answers Type Questions

Q1. What are the main features of Google Maps. Explain in detail?

Q2 What are the application of the Google Map?

Q3 Explain Navigation by Google maps?

Q4 What is Real-time Navigation?

Q5. Describe Business search application.

MAP READING

CHAPTER MR-XIII: INTRODUCTION TO SATELLITE IMAGERY

"Satellite imagery is not just a tool of observation, but a mirror reflecting humanity's impact on the planet."

Satellite Image of India

TEACHING INSTRUCTIONS

Periods	**:**	**01 (40 Mins)**
Types	**:**	**Lecture & Practice**
Year	**:**	**3rd Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Classrooms, Smart Phone, OHP, Board Chalks and Marker

Time Plan

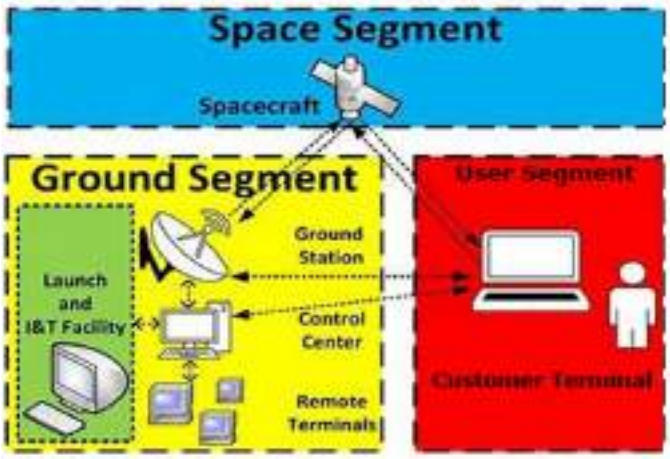
- **Introduction : 02 Mins**
- **Part I : 10 Mins**
- **Part II : 08 Mins**
- **Part III : 10 Mins**
- **Part IV : 08 Mins**
- **Conclusion : 02 Mins**

INTRODUCTION

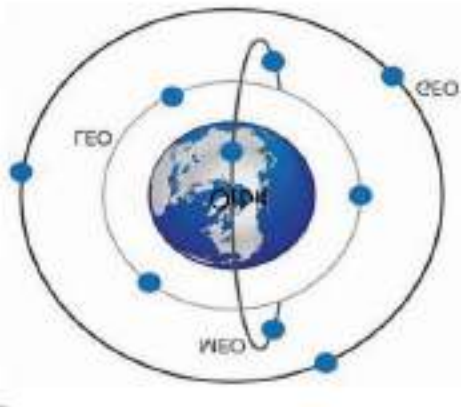
1. Satellite imagery has become an indispensable tool in modern science, offering a bird's-eye view of Earth's diverse landscapes and environments. Through the use of sophisticated satellites orbiting the planet, we can capture high-resolution images that reveal crucial information about weather patterns, environmental changes, urban development and natural disasters. These images are invaluable for researchers, policymakers and conservationists, providing accurate and up-to-date data that enhance our understanding of the world and inform critical decisions. As technology continues to advance, the applications of satellite imagery expand, making it a key asset in addressing global challenges and fostering sustainable development.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ **Part I: Basic Concept and Overview of Satellite System.** ➢ **Part II: History and Development of Satellite System.** ➢ **Part III: Uses & Application of Satellite Imagery.**	➢ **Understanding Basic Concept and Overview of Satellite System.** ➢ **History and Development of Satellite System.** ➢ **Uses & Application of Satellite Imagery.**

PART I: BASIC CONCEPT AND OVERVIEW OF SATELLITE SYSTEM



2. **Definition and overview of a Satellite System**. A satellite system is a network of satellites, ground stations and associated technologies that work together to perform specific tasks, such as communication, navigation, remote sensing, or scientific research. Satellites are artificial objects placed into orbit around the Earth or other celestial bodies to collect data, transmit information, or provide services. These systems play a critical role in connecting, observing and understanding the Earth and beyond.



DID YOU KNOW?

Satellites are placed in orbits based on their intended functions:-

- **Low Earth Orbit (LEO) :** (200–2,000 km altitude) Used for Earth observation and certain communication tasks.
- **Medium Earth Orbit (MEO):** (2,000–35,000 km altitude) Primarily for navigation satellites.
- **Geostationary Orbit (GEO):** (35,786 km altitude) Used for communication and weather satellites as they remain fixed relative to a point on Earth.

INTERESTING FACTS

- **Functions of Satellite Systems are Communication, Navigation, Earth Observation, Scientific Research, Military and Security**.
- **Modern satellites can capture images with resolutions as high to see individual vehicles or even people's shadows**.

PART II: HISTORY AND DEVELOPMENT OF SATELLITE SYSTEM

3. **History and Development of Satellite System**. The history of Satellites is outlined as under:-

(a) In 1957 Soviet Union launched *Sputnik 1***,** the world's first artificial satellite. It marked the start of the space age, demonstrating the feasibility of satellites in orbit.

(b) NASA launched its first Communication Satellite *Echo 1* in 1960. Shortly after, *Telstar 1* became the first active communication satellite, enabling transatlantic television broadcasts.

(c) In 1970 satellite was launched for navigation and to develop Global Positioning System (GPS) by the U.S. Department of Defence. developed It was developed for military use, introducing a precise location tracking.

(d) In 1990s, Private companies began launching satellites for communication, broadcasting and internet services. The rise of direct-to-home (DTH) television and mobile networks transformed industries.

(e) India launched its first satellite, *Aryabhata*, on April 19, 1975, with the help of the Soviet Union.

(f) India developed its Satellite Launch Vehicle (SLV) to launch small payloads. In 1980, Rohini-1 became the first satellite launched by India using the SLV-3.

(g) The PSLV (Polar Satellite Launch Vehicle) became a reliable workhorse for launching satellites, including India's first interplanetary mission, Mangalyaan (Mars Orbiter Mission), in 2013.

(h) India set a world record in 2017 by launching 104 satellites in one mission (PSLV-C37).

PART III: GEOSTATIONARY V/S POLAR-ORBITING SATELLITES

4. **Major Types of Satellites**. Satellites can be broadly classified based on their orbits and functions. The two primary types based on their orbital patterns are geostationary satellites and polar-orbiting satellites which are explained below:-

(a) **Geostationary Satellites**. Satellites that orbit the Earth at an altitude of approximately 35,786 kilometres in the equatorial plane. They match the Earth's rotational speed, appearing stationary relative to a fixed point on the ground.

(b) **Polar-Orbiting Satellites**. Satellites that travel in a low Earth orbit (around 500 to 1,500 kilometres altitude) passing over the Earth's poles on each revolution. The Earth rotates beneath them, allowing full global coverage over time.

COMPARISON: GEOSTATIONARY VERSUS POLAR ORBITING SATELLITES

Feature	Geostationary Satellites	Polar-Orbiting Satellites
Orbit Altitude	~35,786 km.	~500–1,500 km
Orbit Path	Fixed over the equator.	Passes over poles and moves with Earth's rotation.
Coverage	Focused on one region, no polar coverage.	Global, including polar regions.
Applications	Communication, weather monitoring	Earth observation, reconnaissance.
Resolution	Lower due to distance from Earth.	Higher due to proximity to Earth.
Real-Time Coverage	Constant for a fixed area.	Not continuous for a single location.

PART IV: USES & APPLICATION OF SATELLITE IMAGERY

5. **Uses and Applications of Satellite Imagery**. These applications have widespread implications for government agencies, businesses and humanitarian efforts. Here's an overview of how satellite technology is utilized in these areas:-

(a) **Earth Observation and Satellite Imagery**. Earth Observation (EO) refers to the process of collecting data and imagery of the Earth's surface through satellites. This data is use for monitoring, assessing and managing natural resources and the environment.

(b) **Agriculture**. Farmers use satellite imagery for precision agriculture, helping them monitor crop health, soil conditions and water usage. It enables more efficient land management and better crop yield predictions.

(c) **Disaster Management**. During natural disasters such as earthquakes, hurricanes, or floods, satellite imagery helps assess damage, monitor affected areas and coordinate relief efforts. It provides real-time information for better decision-making in emergency situations.

(d) **Military and Defence**. Satellite imagery is crucial for surveillance, reconnaissance and intelligence gathering. It helps in monitoring military activities, borders and strategic locations.

(e) **Weather Forecasting**. Satellites capture weather patterns and atmospheric data, aiding meteorologists in forecasting weather, tracking storms and monitoring ocean currents.

(f) **Transportation and Navigation**. Satellite imagery is essential for creating detailed maps and monitoring transportation networks, including roads, railways and airports. It aids navigation systems by providing accurate maps, tracking ships and providing geospatial data for search and rescue.

DID YOU KNOW?

- The most famous Indian satellite for agricultural satellite imagery is **Cartosat-1** and its successors, specifically the **Cartosat-2** and **Cartosat-3** series.
- **Cartosat-3** is specifically known for its very high-resolution imagery (up to 25 cm resolution), making it one of the most advanced satellites for Earth observation.
- India sells satellite imagery from its Cartosat series and other remote sensing satellites (such as IRS) to various countries

HOT

- Analyse the role of satellite systems in agriculture. How does satellite imagery contribute to precision agriculture, and what potential challenges do farmers face in adopting this technology?
- Compare and contrast the uses of satellite imagery for disaster management and military defence. How do the goals and applications of satellite systems differ in these contexts?
- Discuss the advancements in India’s satellite technology, from Aryabhata to Mangalyaan. How has India's space program evolved, and what impact has it had on global satellite systems?

CONCLUSION

6. Satellite systems play a vital role in various industries by providing essential services such as communication, navigation, weather forecasting and Earth observation. Through the advancements in satellite technology, nations have made significant strides in space exploration, launching numerous satellites for diverse applications. The development of satellite systems, including geostationary and polar-orbiting satellites, has transformed how we monitor and manage natural resources, aid disaster response and enhance military surveillance, making them indispensable tools for global connectivity and progress.

SUMMARY

- Satellites are artificial objects placed into orbit around the Earth or other celestial bodies to collect data, transmit information, or provide services.
- A satellite system is a network of satellites, ground stations and associated technologies that work together to perform specific tasks.
- Functions of Satellite Systems are Communication, Navigation, Earth Observation, Scientific Research, Military and Security.
- Satellite imagery has become an indispensable tool in modern science, offering a bird's-eye view of Earth's diverse landscapes and environments.
- In 1957 Soviet Union launched *Sputnik 1*, the world's first artificial satellite. It marked the start of the space age.
- India launched its first satellite, Aryabhata, on April 19, 1975, with the help of the Soviet Union.
- India set a world record by launching **104 satellites** in one mission.
- The applications of satellite imagery support efficient land use, disaster response, defence strategies and weather predictions.
- India sells satellite imagery from its Cartosat series and other remote sensing satellites (such as IRS) to various countries

ASSESMENT EXERCISE

Multiple Choice Questions

Q1. What is the name of the path a satellite follows around the Earth?

(a) Trajectory (b) Orbit (c) Axis (d) Revolution

Q2. What significant achievement is the PSLV (Polar Satellite Launch Vehicle) known for?

(a) Launching India's first manned space mission
(b) Launching satellites and India's first interplanetary mission, Mangalyaan, in 2013
(c) Launching the first global satellite navigation system
(d) Developing India's first space station

Q3. At what altitude do geostationary satellites typically orbit the Earth?

(a) 500 km (b) 1,000 km (c) 35,786 km (d) 50,000 km

Q4. Which of the following is known for its very high-resolution imagery of up to 25 cm resolution?

(a) Cartosat-1 (b) Cartosat-2 (c) Cartosat-3 (d) IRS

Q5. When was India's first satellite, Aryabhata, launched?

(a) 1960 (b) 1975 (c) 1980 (d) 1990

Q6. Which satellite was the first to be launched by India using the Satellite Launch Vehicle (SLV-3)?

(a) Mangalyaan (b) Rohini-1 (c) Aryabhata (d) INSAT-1

Q7. Which organization launched the first artificial satellite, Sputnik 1?

(a) NASA (b) European Space Agency (c) Soviet Union (d) ISRO

Q8. What is Earth Observation (EO)?

(a) The process of using satellites to monitor weather patterns
(b) Collecting data and imagery of the Earth's surface through satellites
(c) Monitoring space activities
(d) Observing atmospheric changes through ground stations

Q9. How does satellite imagery help in agriculture?

(a) By predicting the weather conditions for the entire country
(b) By planting crops using automated drones
(c) By monitoring crop health, soil conditions and water usage
(d) By conducting genetic research on plants

Q10. What world record did India set in 2017?

(a) Launching the first interplanetary mission
(b) Launching 104 satellites in one mission
(c) Developing a new satellite technology
(d) Successfully launching Mars Orbiter

Q11. What is a notable feature of the Cartosat satellite series?

(a) It focuses on weather forecasting
(b) It is used for agricultural satellite imagery and Earth observation
(c) It is designed for satellite communication
(d) It specializes in space exploration

Q12. What role does satellite imagery play in military and defence?

(a) It helps in surveillance, reconnaissance and intelligence gathering
(b) It aids in military training and exercises
(c) It is used to manage military supplies and resources
(d) It assists in military personnel recruitment

Q13. How does satellite imagery assist in weather forecasting?

(a) By monitoring global economic conditions
(b) By capturing weather patterns and atmospheric data for forecasting and storm tracking
(c) By monitoring the Earth's internal structure
(d) By providing data for agricultural purposes

Q14. How many Types of Orbits are used based on the functioning of Satellites?

(a) Two (b) Three (c) Four (d) Five

Q15. Name world’s first artificial satellite.

(a) Star link
(b) Sputnik1
(c) Galileo
(d) One web

Short Answers Type Questions

Q1. How does satellite help in urban planning development?

Q2. Define Satellite system.

Q3. Discuss types of satellite based on their application?

Q4. Write down at least three characteristics of Geo stationary satellites and Polar satellites distinguished from each other?

Q5. How does Satellites contribute in Disaster Management?

Long Answers Type Questions

Q1. Discuss the classification of satellite into various categories?

Q2. Elucidate various of application of satellite imagery?

Q3. Write any five uses of satellite systems.

Q4. How satellite imagery assists in Military and Defence?

Q5. What are the components of Satellite System?

MILITARY WEAPONS & EQUIPMENTS

5

CHAPTER WISE INDEX: MILITARY WEAPON & EQUIPMENT (JD/JW)

MILITARY WEAPON & EQUIPMENTS (SD/SW)

CHAPTER MWE-I: ORGANISATION OF AN INFANTRY BATTALION AND ITS WEAPONS

"The Infantry doesn't claim to have done it all, but without them, nothing else gets done."

"युद्धाय कृतनिश्चयः।"

TEACHING INSTRUCTIONS

Period	**:**	**03 (120 Mins)**
Type	**:**	**Lecture and Practice**
Year	**:**	**1st Year (02) & 3rd Year (01)**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class room, OHP, Board and Chalk/Markers

Time Plan

➢ **Introduction**	**:**	**05 Mins**
➢ **Part I**	**:**	**35 Mins**
➢ **Part II**	**:**	**35 Mins**
➢ **Conclusion and Summary**	**:**	**05 Mins**
➢ **Visit to Infantry Battalion**	**:**	**40 Mins (Practical)**

INTRODUCTION

1. The Infantry Battalion stands as the cornerstone of the Indian Army, embodying resilience, versatility, and unyielding commitment to safeguarding the nation's sovereignty. As the primary combat force, the Infantry Battalion is meticulously trained and equipped to operate effectively under the most challenging and adverse conditions, demonstrating unmatched adaptability and endurance. Uniquely capable of fighting both independently and as part of a larger force, the Infantry Battalion's operational versatility makes it indispensable in modern warfare. Whether executing offensive operations, holding defensive positions, or undertaking specialized missions, the battalion is designed to persevere and succeed, even against formidable adversaries. Its inherent sustenance power, coupled with the unwavering motivation of its personnel, enables it to maintain combat effectiveness and morale through protracted engagements.

2. The Infantry Battalion's balanced force structure equips it to adapt seamlessly to diverse combat scenarios. In offensive operations, it can breach fortified enemy positions and dominate the battlefield. During defensive operations, it excels in holding critical terrain and repelling enemy advances. Moreover, its proficiency in special operations ensures it can execute precision missions that demand stealth, speed, and tactical excellence. The battalion's combat capabilities are further enhanced by its integral support weapons, which provide decisive firepower. These support weapons, including the 81mm Mortar and the Anti-Tank Guided Missile (ATGM) form the backbone of its firepower at extended ranges.

3. In addition to these weapons, the Infantry Battalion integrates its firepower with the strategic use of fortified positions, mobility tactics, and synchronized maneuvers. These attributes ensure that the battalion can effectively disrupt enemy plans, cause maximum damage, and dominate the battlefield across diverse operational theaters. Ultimately, the Infantry Battalion exemplifies the ethos of the Indian Army - a balanced, determined, and relentless force, prepared to defend the nation and achieve victory under any circumstances.

INTERESTING FACTS

- **Largest & Oldest Combat Arm**.
- **Largest Contributor to the United Nations**.
- **Specialises In High Altitude Warfare**.
- **Queen of the Battle**.
- **Highest Param Vir Chakras**.

PREVIEW

- **Part I: Infantry Battalion Organisation**
- **Part II: Capability & Basic Weapons**.

LEARNING OBJECTIVES

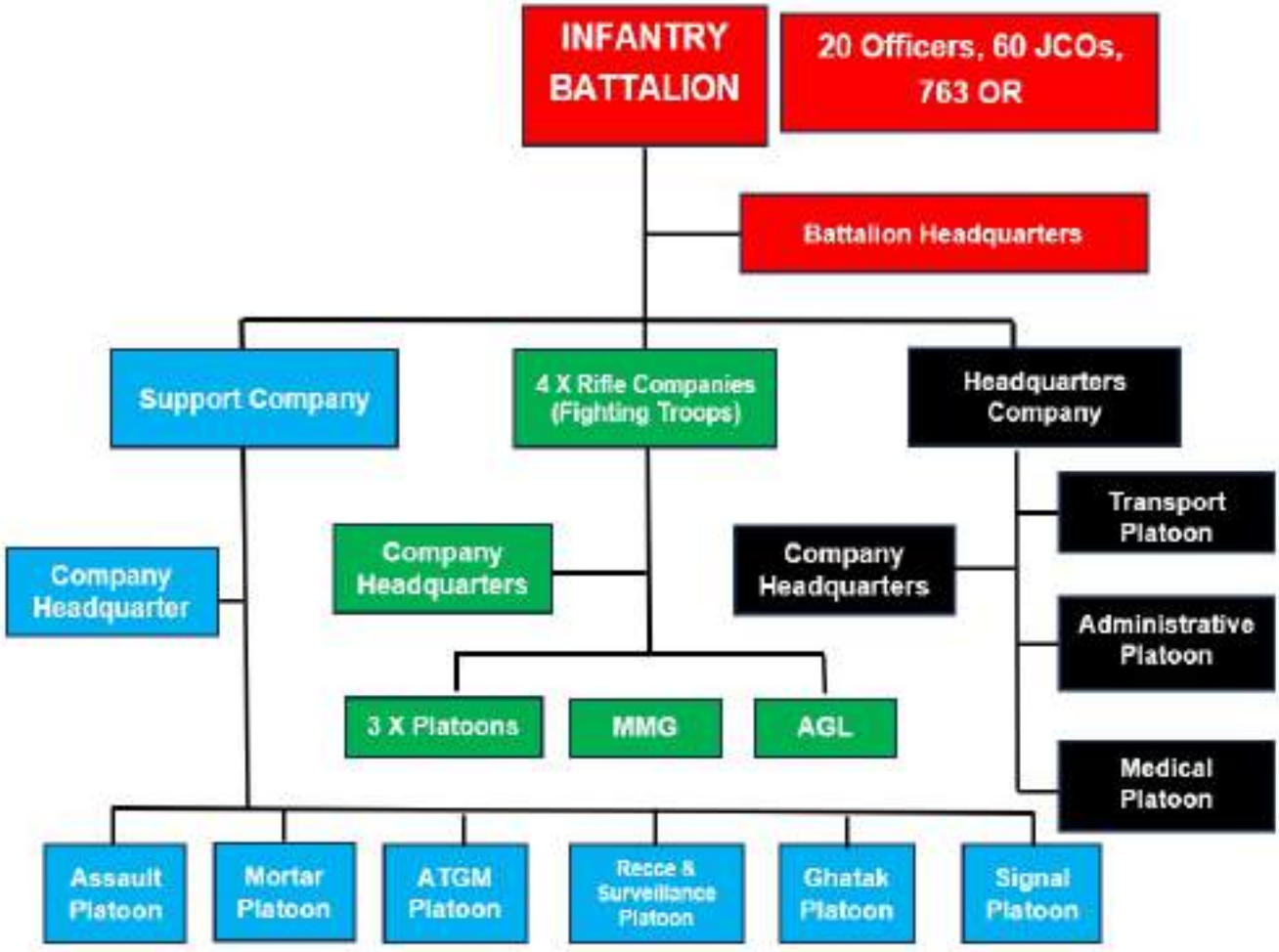
- **Organization of Infantry Battalion & Its Constituents**
- **Capability & Employability**

PART I: ORGANISATION OF INFANTRY BATTALION

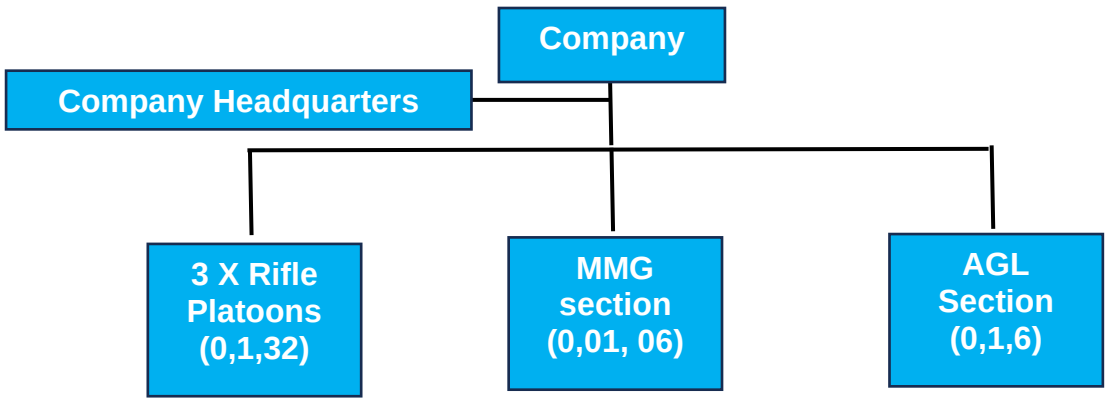
4. The Infantry battalion is the most important organisation of the Indian Army. It is trained and equipped to face any threats and challenges. It has the capability to attack/defend and hold ground as per task assigned. It can fight an enemy independently or as part of a larger force. It has the sustenance power and motivation to fight till last man last round. The Infantry battalion has **Four Rifle Companies**, each Company has **Three Platoons** and Each Platoon has **Three Sections**.

5. To Support the rifle companies to fight there is a requirement of various Support organisations within the battalion like administrative support, communication, recce and surveillance etc. To keep these support organisations at one place there is **One Support Company** within the battalion. Also to keep command and Control elements at one place, there is another company called as **Headquarter Company**.

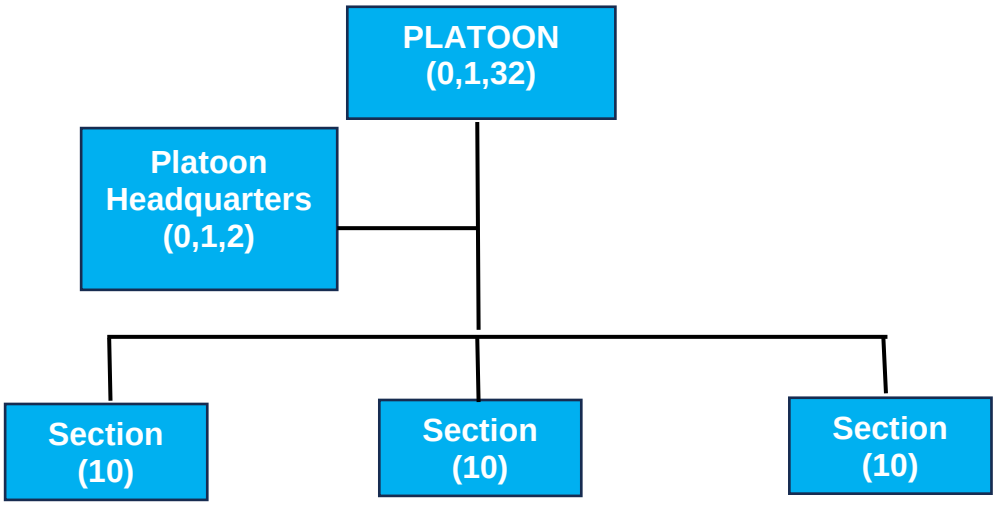
ORGANISATION OF INFANTRY BATTALION



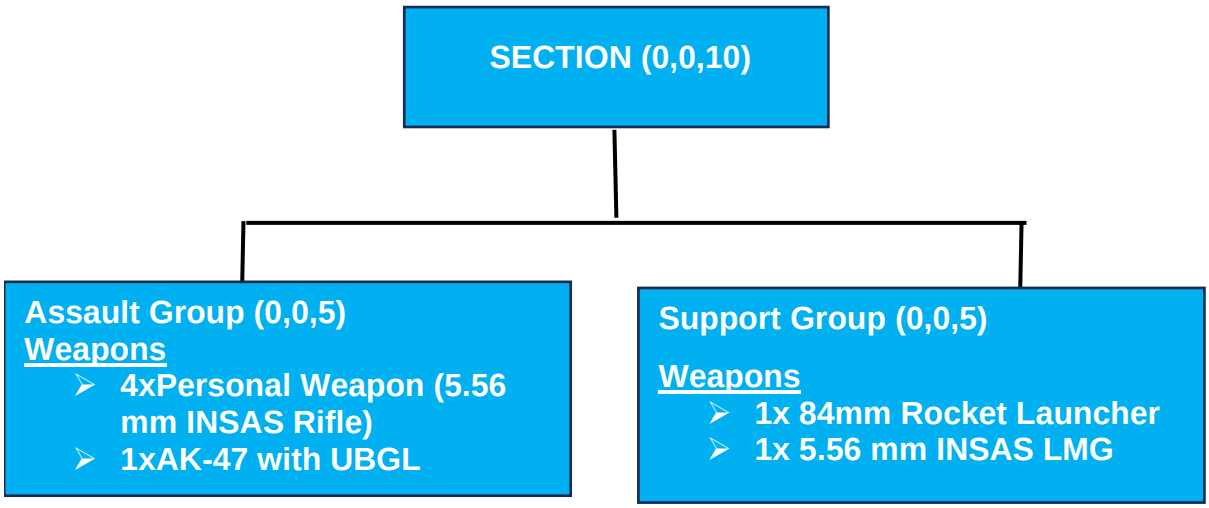
02 OFFICERS, 07 JCOs AND 117 OR (HAV, NKs & SEP)



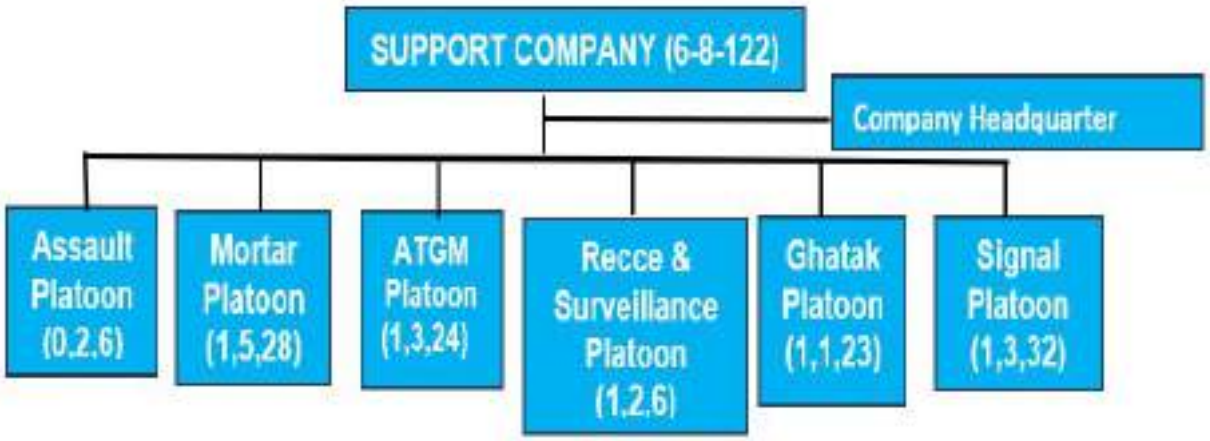
7. **Rifle Platoon**. The Rifle Platoon plays a crucial role in the combat operations of an Infantry Battalion's Rifle Company. It brings together soldiers who have undergone rigorous training and maintains strict discipline, enabling them to carry out tactical missions in a wide range of settings. The platoon comes equipped with light firearms and backup weaponry making it ready to take on offensive and defensive tasks as well as scouting duties. Led by a Junior Commissioned Officer, the Platoon serves as the core of the battalion's fighting power.



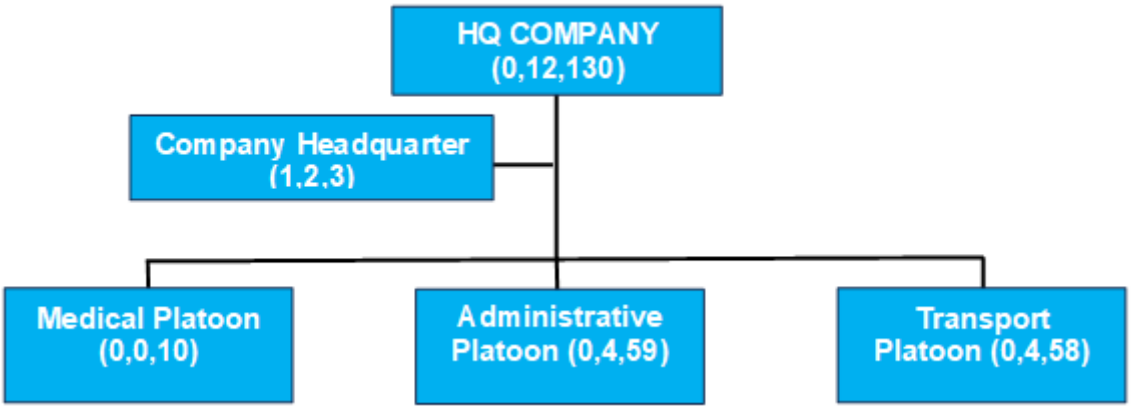
8. **Rifle Section**. Rifle Section is the smallest combat element of an Infantry Battalion consisting of 10 soldiers. This is the basic fighting unit which can operate independently in hand to hand combat situations. Commanded by a Non Commissioned Officer, it is a well-coordinated and swift team that employs small arms and support weapons in the pursuit of tactical objectives.



9. **Support Company**. The Support Company of an Infantry Battalion is vital in accomplishing operational success of the battalion through provision of the required support in firepower, reconnaissance, and communication. It consists of various Platoons, all of whom are trained to meet needs in the battlefield. The ATGM Platoon is Anti Tank Guided Missile Platoon capable of destroying enemy tanks by firing wire guided Missiles.



10. **HQ Coy**. The Headquarter (HQ) Company of an Indian Army Infantry Battalion serves as the command-and-control center, ensuring seamless coordination and execution of operations. It is the backbone of the battalion, providing logistical, administrative, and operational support to all other companies.



11. **Capabilities**. The capabilities of Infantry Battalion are as under:-

(a) **Self Reliance**. The trained soldiers are ready to independently engage with their opponents without being aided in combat by any other forces as the Infantry possesses all the necessary deterrents.

(b) **Ability to Hold Ground**. An Infantry battalion is competent enough to stand their ground with or without external assistance.

(c) **Adaptability**. An Infantry battalion can perform on all the types of terrains during all the time, even under difficult climatic conditions. The Infantry battalion can be readily transported by land, sea, or air to the battle area.

(d) **Mobility**. Infantry battalion gets the greatest mobility. It can go almost anywhere and everything including nearly all barriers.

(e) **Vulnerability**. An Infantry battalion is in jeopardy of being assaulted with devastating attacks from any charging tanks, artillery fire, small weapon artillery, aerial bombardments and anti-personnel mines.

12. **Employability**. At a fundamental level, an Infantry battalion is tasked with physically engaging enemy forces while seizing or defending territory. The use of firepower in conjunction with movement forms the basis of Infantry tactics. This understanding is fundamental for any Infantry battalion starting from a section level upwards. An Infantry battalion along with its sub-units is trained in accomplishing missions against the enemy in a wartime area without the need for complete reliance on support by other arms but through effective combination of terrain, weapon systems, and above all the Infantry men with their determination, courage, and desperation.

PART II: BASIC WEAPONS OF INFANTRY BATTALION

13. **Personal, Company/Battalion Support Weapons**. Personal/basic weapons of a soldier of Infantry Battalion consists of weapons such as 5.56mm INSAS Rifle, 7.62mm AK-47 along with Under Barrel Grenade Launcher, Carbine, 9mm Pistol, Number 36 Hand Grenade, 84mm Rocket Launcher, 7.62mm Sniper Dragunov and 5.56mm INSAS LMG. Apart from this there are company level support weapons like 30mm Automatic Grenade Launcher (AGL) and 7.62mm Medium Machine Gun (MMG). Battalion Support Weapons like 81mm Mortar and Anti-Tank Guided Missile (ATGM) are held by Support Company and are used on orders from the Battalion Commander. Details are given in tabulated form below.

5.56MM INSAS RIFLE

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Weight	3.69 kg
Calibre	5.56 mm
Length of Rifle	960 mm
Effective range	400 metres
Principle of Operation	Gas Operated
Mode of fire	Single Shot, Three Round Burst (TRB)
Rate of Fire	
Normal	60 rounds/minute
TRB	90 rounds/minute
Intense	150 rounds/minute
Cyclic	600-650 rounds/minute

5.56MM INSAS LMG (LIGHT MACHINE GUN)

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Weight with Bipod	7.2 kg
Calibre	5.56 mm
Length with Bipod	1030 mm
Effective range	700 metres
Principle of Operation	Gas Operated, Rotating Bolt Mechanism
Mode of fire	Single Shot and Automatic
Rate of Fire	
Normal	60 rounds/minute
Intense	120 rounds/minute
Cyclic	600 rounds/minute

7.62 MM DRAGUNOV SNIPER RIFLE

SPECIFICATION/ FEATURES

Manufacturer	Soviet Union
Weight with Bipod	4.3 kg
Calibre	7.62 mm
Length with Bipod	1030 mm
Effective range	800 metres
Range with telescope sight	1300 meter
Magazine capacity	10 rounds
Ammunition Fired	• Armor Piercing. • Sniper Balls. • Steel Core. • Tracer. • Incendiary.

84 MM RL (ROCKET LAUNCHER)

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Caliber	84mm
Weight	16 kg with mount and telescopic sight
Length	1065 mm
Range	• HEAT - 400m (moving targets) and 500 m (stationery targets). • HE - 1000m (killing area 10 m). • Smoke - 1300 m (width 15 m). • Illumination - 2100 m (area of 400-500 m diameter for 30 seconds).
Rate of Fire	Maximum sustained 06 rounds per minute
Armor Penetration	400 mm (Heat)
Types of ammunition	Heat, HE, Smoke, Illumination
Back Blast Area	15 metres

COMPANY SUPPORT WEAPONS

30MM AUTOMATIC GRENADE LAUNCHER (AGL)

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Weight Launcher	14.2 kg
Weight Mount	10.2 kg
No. of rounds in belt	235 rounds
Range of Fire	800 to 1700 metre (with or without sight)
Rate of Fire	
Normal	50 Grenades/minute
Rapid	100 Grenades /minute
Cyclic	350 to 400 Grenades /minute

7.62MM MMG (MEDIUM MACHINE GUN)

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Weight Gun	14.2 kg
Weight Tripod	10.2 kg
No. of rounds in belt	235 rounds
Effective range	1800 metre
Rate of Fire	
Normal	100 rounds/minute
Rapid	200 rounds/minute
Cyclic	500-1000 rounds/minute
Sustained Fire	Being air-cooled can maintain normal rate of fire indefinitely. However, barrel should be changed after firing four belts.

BATTALION SUPPORT WEAPONS
81MM MORTAR

SPECIFICATION/ FEATURES

Manufacturer	Indian Ordnance Factory Board
Caliber	81mm
Weight	40.6 kg (without sight). 4.7 kg (sight without case)
Muzzle velocity	305 metre/sec
Range	Minimum – 68 meters (from safety point of view 90 m). Maximum – 5200 metres
Rate of Fire	
Slow	6 – 8 rounds/minute
Normal	9– 11 rounds/minute
Rapid	12-20 rounds/minute
Safety Distance	Flanking 200 metre Overhead 250 metres

ANTI-TANK GUIDED MISSILE (MILAN-2T)

SPECIFICATION/ FEATURES

Milan-2T is a man portable second generation ATGM, to destroy tanks fitted with Explosive Reactive Armour, moving and stationary targets

Manufacturer	Bharat Dynamics Limited
Range	25 metre - 2000 metre
Weight of Launcher	Missile in Logistic Container 80 kg
	Missile in Tactical Packing-11.8 kg
Missile Length	769mm
Launch Tube Length	1200mm
Caliber	115mm
Operating Temp	40 to 50 degree C
Hit Probability	90 to 95% (more then 300m)
Velocity	75 – 210 m/sec
Time to Flight	12.5 sec

CONCLUSION

14. Infantry Battalion, the cadets would have realised is the bed rock of the Indian Army. Highly trained and motivated, the Infantry man stands guarding our borders 24x7 and 365 days in a year. Today, Infantry Battalion has state of art weapons and equipment details of which have been taught to the cadets. The modernization is a continuous process and, in the days, ahead it will only be better. However, it is not only the technology that matters. What matters most is the Infantryman who uses the weapon with lethality. The Infantry is the Cutting Edge of the Indian Army and is ready for future wars.

SUMMARY

- **5.56 INSAS Rifle**. A lightweight, compact, and low-recoil personal weapon used by the Indian Army, part of the Indian Small Arms System (INSAS). It is 25% lighter and has 70% less recoil than the 7.62 mm SLR, making it easier to handle and fire.

- **Ammunition Types**.
  - Ball rounds
  - Tracer rounds
  - Blank rounds
  - High-density cartridges

- **Infantry Battalion**. The basic fighting unit of the Indian Army, capable of operating independently or as part of a larger force. Its strength comprises 20 officers, 42 JCOs, and 794 other ranks:-
  - Smallest Unit: A section.
  - Capabilities:
  - Self-reliance
  - Ability to hold ground
  - Adaptability to various situations
  - High mobility

- **Company Support Weapons**. Essential for enhancing combat effectiveness, including:-
  - 7.62 mm Dragunov Sniper Rifle
  - 7.62 mm Medium Machine Gun
  - 30 mm Medium Grenade Launcher
  - 84 mm Rocket Launcher

- **Battalion Support Weapons**. These weapons are critical in causing maximum casualties to the enemy and are extensively used in offensive, defensive, and special operations:
  - Types.
  - 81 mm Mortar
  - Anti-Tank Guided Missile (ATGM)
  - Key Features: Include weight, range, rate of fire, muzzle velocity, and elevation, essential for cadets to understand.

ASSESSMENT EXERCISE

Multiple Choice Question

Q1. What is the basic fighting unit of the Indian Army?

(a) Section
(b) Infantry Battalion
(c) Brigade
(d) Division

Q2. How many officers are typically present in an Infantry Battalion?

(a) 15
(b) 19
(c) 25
(d) 30

Q3. What is the smallest fighting unit of an Infantry Battalion?

(a) Platoon
(b) Section
(c) Company
(d) Regiment

Q4. Which of the following is a capability of an Infantry Battalion?

(a) Flying
(b) Self-reliance
(c) Heavy artillery operation
(d) None of the above

Q5. Which rifle is part of the Indian Small Arms System (INSAS)?

(a) 7.62 mm SLR
(b) 5.56 INSAS Rifle
(c) AK-47
(d) Dragunov Sniper Rifle

Q6. What type of ammunition is not used with the 5.56 INSAS Rifle?

(a) Ball round
(b) Blank round
(c) High-density cartridge
(d) Explosive round

Q7. What is the range of the 7.62 mm Dragunov Sniper Rifle?

(a) Short-range
(b) Medium-range
(c) Long-range
(d) Ultra-long-range

Q8. Which of these is a company support weapon?

(a) 81 mm Mortar
(b) Anti-Tank Guided Missile
(c) 30 mm Medium Grenade Launcher
(d) Swathi Radar System

Q9. What is the primary purpose of an 81 mm Mortar?

(a) Anti-aircraft defence
(b) Heavy artillery support
(c) Indirect fire support
(d) Close combat

Q10. Which weapon system is primarily used against tanks?

(a) Rocket Launcher
(b) 81 mm Mortar
(c) Anti-Tank Guided Missile
(d) Medium Machine Gun

Q11. What does INSAS stand for?

(a) Indian National Small Arms System
(b) Indian Small Arms System
(c) Infantry Small Arms System
(d) International Small Arms System

Q12. Which capability is NOT associated with an Infantry Battalion?

(a) Mobility
(b) Adaptability
(c) Maritime warfare
(d) Holding ground

Q13. What is the recoil percentage reduction of the 5.56 INSAS Rifle compared to the 7.62 mm SLR?

(a) 50%
(b) 60%
(c) 70%
(d) 80%

Q14. Which company support weapon is used for precision targeting?

(a) Medium Machine Gun
(b) Dragunov Sniper Rifle
(c) Grenade Launcher
(d) Rocket Launcher

Q15. What is the main feature evaluated in Infantry Battalion support weapons?

(a) Cost
(b) Elevation
(c) Weight and range
(d) Both (b) and (c)

Short Answer Type

Q1. What are the types of ammunition used with the 5.56 INSAS Rifle?

Q2. What are the key capabilities of an Infantry Battalion?

Long Answer Type

Q1. Explain the structure and capabilities of an Infantry Battalion in detail.

Q2. Describe the role and characteristics of company support weapons in an Infantry Battalion.

Q3. Discuss the types and features of Infantry Battalion support weapons.

SPECIALISED SUBJECT (ARMY)

MWE-II: MILITARY WEAPONS & EQUIPMENTS (SD/SW)

"Weapons are tools of peace when held with discipline, but tools of destruction when used without wisdom."

"वीरता धर्मश्च शस्त्रस्य भूषणम्।"

(Courage and righteousness are the ornaments of a weapon)

TEACHING INSTRUCTIONS

Period	**:**	**04 (160 Mins)**
Type	**:**	**Lecture**
Year	**:**	**1st Year (01) & 2nd Year (03)**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, OHP, Board and Chalk/Markers

Time Plan

• **Introduction**	**:**	**02 Mins**
• **Part I**	**:**	**38 Mins**
• **Part II**	**:**	**40 Mins**
• **Part III**	**:**	**35 Mins**
• **Part IV**	**:**	**40 Mins**
• **Conclusion & Summary**	**:**	**05 Min**

INTRODUCTION

1. It is essential for any responsible citizen to understand the key weapon systems used by the Indian Army, which are integral to its operations and national defence. Therefore, the advanced technology and importance of these systems in safeguarding our country must be well understood by cadets. It is also imperative for the cadets to understand that in today's world being militarily strong is a necessity to protect the sovereignty of a country from external and internal threats. Towards that end, in the last decade or so India in its call for "ATMANIRBHAR BHARAT" has substantially increased indigenous production of military equipment. In this lesson, the cadets will explore operational capabilities of major weapon systems, such as tanks, artillery, missiles and aircraft, which form the backbone of India's military strength.

2. The lesson will give a brief of how these weapons are designed, their unique features, and the role they play in modern warfare. By understanding their functionality, the cadets will gain insight into how these systems support both offensive and defensive military operations. Additionally, their role in achieving military objectives from battlefield superiority to deterrence, and how they help maintain peace and security will be studied. The lesson aims to build technical knowledge and foster an appreciation for the dedication and discipline required to operate these systems effectively.

INTERESTING FACTS

- **The Brahmos missile took just 4 years (from 2001 to 2005) to develop, making it one of the fastest missile development programs in the world Brahmos missile is named after Brahmaputra River (India) and Moskva River (Russia), this missile became the first supersonic cruise missile in the world to be launched from a submarine in 2013**.

PREVIEW

The lecture will be conducted in the following parts:

- **Part I: Armoured & Mechanised Infantry.**
- **Part II: Artillery & Rockets.**
- **Part III: AAD & Missile System.**
- **Part IV: UAVs & Major Equipment.**

LEARNING OBJECTIVES

- **Be aware of major weapons & equipment being used by the Indian Army**.
- **Understands the operational capabilities of weapons & appreciate their role in defending the nation from external threats**.
- **The relevance of 'Make in India'**.

PART I: ARMOURED AND MECHANISED INFANTRY

3. **Tanks**. Tanks are heavily armoured combat vehicles with powerful guns, forming the backbone of mechanized Infantry and armoured divisions. Designed for direct fire combat, they excel in breaking enemy lines and manoeuvring over rough terrain.

4. **Key Features**:

(a) **Armour**. Thick steel/composite protection against anti-tank weapons.

(b) **Weaponry**. Large-calibre main gun (105mm–125mm) with secondary armament.

(c) **Mobility**. Tracks enable movement across difficult terrains.

(d) **Crew**. Typically consists of a driver, gunner, loader, and commander.

(e) **Role**. Provides offensive firepower, supports Infantry, and leads breakthroughs.

5. **BMP (Infantry Fighting Vehicle)**. The BMP is a Soviet-designed Infantry fighting vehicle that transports troops while providing fire support. Unlike APCs, it is armed to engage targets independently, balancing mobility and firepower.

6. **Key Features**:

(a) **Armour**. Lighter than tanks but protects against small arms and shrapnel.

(b) **Weaponry**. Equipped with automatic cannons, ATGMs, and machine guns.

(c) **Mobility**. Tracks ensure excellent cross-terrain movement.

(d) **Role**. Transports Infantry and offers fire support.

(e) **Crew & Infantry**. Holds 3-4 crew members and 6-8 Infantrymen.

FEATURES	SPECIFICATION
CREW	3 (COMMANDER AND TWO GUNNER)
WEIGHT	46 TONS
MAX SPEED	60 KM/HR
RANGE	550 KM
ARMAMENT	125mm gun (Main Weapon), 7.62mm Coaxial MG, 12.7mm MG,7.62 mm PKMT
AMMUNITION	HESH, HEAT, MISSILE, SMOKE, ILLUMINATION

7. **T 90 Main Battle Tank (Bhishma Indian Version)**. T-90 is a cutting-edge main battle tank, originally developed in Russia and later upgraded for the Indian Army as "Bhishma." It combines powerful firepower, mobility, and protection, making it a key asset in modern warfare. It excels in both offensive and defensive operations. Its adaptability to extreme weather and challenging terrains has been proven in combat zones like Rajasthan's deserts and Ladakh's high altitudes.

DID YOU KNOW?

- The T-90 Bhishma uses Kontakt-5 explosive reactive armour, which can neutralize the impact of enemy projectiles, including advanced kinetic energy penetrators.
- The T-90 Bhishma is equipped with the Shtora-1 system, a defensive technology designed to jam the guidance systems of incoming anti-tank missiles, significantly increasing its survivability in combat.
- T-90 Bhishma has been strategically deployed in high-altitude areas like Eastern Ladakh during tensions with neighbouring countries, proving its adaptability to extreme conditions.

8. **Main Battle Tank (MBT) ARJUN** India's indigenously developed third-generation main battle tank, the MBT Arjun, is designed by DRDO to enhance the Indian Army's armoured warfare capabilities. Named after the Mahabharata warrior Arjuna, it symbolizes strength, precision, and innovation. A key asset in the armoured corps, the Arjun excels in offensive and defensive operations. With advanced technology, superior firepower, and robust armour, it performs effectively in diverse environments, including Rajasthan's deserts and semi-urban terrains. Its precision targeting and strong protection make it invaluable in sustained combat scenarios.

FEATURE	SPECIFICATION
CREW	4
WEIGHT	58.5 Tons
MAX SPEED	60 Kmph
RANGE	450 km
ARMAMENT	120 mm Rifled Gun (Main Weapon), 7.62 mm Coaxial MG, 12.7 mm Anti-Aircraft MG
AMMUNITION	HESH, HEAT, Smoke, Illumination.

DID YOU KNOW?

- During comparative trials conducted in 2010, the Arjun outperformed the T-90 in firepower, accuracy, and mobility, proving its capability as a modern battle tank.
- The Arjun tank's commander's panoramic sight allows 360-degree surveillance, providing superior battlefield awareness for its crew.
- Arjun's hydropneumatics suspension is not only a rarity in tanks but also provides exceptional ride quality and stability, even on rough terrains.

9. **ICV BMP2 Infantry Fighting Vehicle (IFV)**. The Soviet-designed BMP-2 is a key IFV in the Indian Army, used by Mechanized Infantry Regiments. It transports Infantry while providing fire support and protection, upgraded to meet Indian Army requirements.

10. Key Features of IFV are as under:-

(a) **Role**. Infantry transport, fire support.

(b) **Armament**. 30mm automatic cannon, 7.62mm coaxial machine gun, AT-5 Spandrel missiles.

(c) **Armour**. Protects against small arms fire, shell splinters, and some larger projectiles.

(d) **Mobility**. Tracked, high road speed, amphibious capability.

FEATURE	SPECIFICATION
TYPE	Infantry Fighting Vehicle (IFV)
WEIGHT	14.3 tons
CREW	3 + 7 passengers
RANGE	600 km (road)
ANTI-TANK CAPABILITY	2 x AT-5 Spandrel (ATGM)
GUIDANCE SYSTEM FOR ATGM	Semi-automatic command-to-line-of-sight (SACLOS)
NBC PROTECTION	Yes
SERVICE ENTRY (INDIAN ARMY)	1980s

11. **Applications in Indian Army are as under:-**

(a) The BMP-2 is a crucial component for Indian Mechanized Infantry, providing quick mobility, firepower and protection.

(b) The Indian Army has upgraded BMP-2 with better armour, enhanced fire control systems and advanced communications for modern warfare.

DID YOU KNOW?

- The BMP-2 was extensively used during the Kargil War (1999) to provide fire support to Infantry units in high-altitude combat, proving its effectiveness even in extreme environments.
- The BMP-2 is designed to be air-transportable and can be quickly deployed using IL-76 or C-17 Globemaster aircraft, making it a rapid-response asset in emergencies.
- Future upgrades for the BMP-2 include remote weapon stations, where the gunner can operate the armament without exposing themselves to enemy fire.

PART II: ARTILLERY AND ROCKETS

12. **Artillery in the Indian Army**. Artillery is a key component of the Indian Army, providing long-range fire support to Infantry and armoured units. It includes large-calibre guns, howitzers, and mortars, capable of delivering powerful firepower at extended distances. Artillery is used for bombardment, counter-battery fire, and supporting offensive and defensive operations.

13. The Indian Army's Artillery is undergoing major upgradation. Some of the equipment being used at present are as under:-

(a) **155mm Howitzers**. M777 and Dhanush, for precision fire support.

(b) **Medium & Heavy Mortar 120mm**. For close support and high-angle fire.

(c) **Field Guns**. Used in direct-fire support.

Rockets in the Indian Army

14. The Indian Army also uses multiple rocket launcher systems (MRLS) for mass fire support. These systems are designed to deliver a high volume of rockets quickly over a large area, causing significant damage to enemy formations.

15. Prominent rocket systems used by Artillery are as under:-

(a) **Pinaka**. A multi-barrel rocket launcher system, capable of delivering devastating barrages at a range of 40-75 km.

(b) **Smerch**. A Russian-made long-range rocket launcher, effective at targeting large enemy formations.

16. These artillery and rocket systems play a crucial role in providing firepower, enhancing the Indian Army's operational capabilities.

17. **155 mm Artillery Gun (BOFORS)**. The 155mm Bofors Gun is a highly effective field artillery weapon used by the Indian Army. Known for its exceptional accuracy, range, and firepower, it has been a game-changer in modern artillery warfare. The gun is designed to provide long-range fire support and has proven its capabilities in both defensive and offensive operations.

18. The 155mm Bofors Gun is a cornerstone of the Indian Artillery's firepower, renowned for its reliability and effectiveness in both conventional and counter-insurgency operations. Its ability to deliver sustained and accurate firepower makes it indispensable in achieving battlefield dominance.

FEATURES	SPECIFICATIONS
TYPE	Long range fire support, precision bombardment, counter-battery fire
SHELL TYPES	High explosive, smoke, and illumination rounds
CALIBER	155mm
MOBILITY	Towered artillery system with excellent maneuverability across varied terrains
RANGE	Effective range: Up to 30km Extended range: Up to 40km with rocket assisted projectile
CREW	6-8 personnel
SPECIAL FEATURE	Semi-automatic loading system for higher rates of fire
RATE OF FIRE	3 rounds in 15 seconds

DID YOU KNOW?

- The 155mm Bofors gun played a crucial role in the 1999 Kargil War, effectively targeting enemy positions in high-altitude terrain.
- The gun is designed for high rates of fire, enabling it to maintain prolonged bombardment during intense battlefield scenarios.

19. **Pinaka Multi Barrel Rocket Launcher**. The Pinaka Multi-Barrel Rocket Launcher (MBRL) is an indigenous artillery system developed by DRDO for the Indian Army. Named after Lord Shiva's bow, it delivers heavy firepower rapidly, targeting critical enemy positions. Used effectively in the 1999 Kargil War, it fires guided or unguided rockets. The advanced Mark-II version offers improved range and accuracy, enhancing its strategic value.

(a) **High Firepower**. Pinaka can fire a volley of 12 rockets within 44 seconds, effectively delivering a large amount of firepower in a short time.

(b) **Extended Range**. The Mark-II version has an extended range of up to 75 km, giving it a significant advantage in modern combat situations.

(c) **Multiple Warheads**. Capable of firing different types of warheads, including fragmentation and high-explosive, making it versatile for various combat scenarios.

(d) **Mobile and Rapid Deployment**. The system is mounted on a mobile platform, enabling rapid deployment in battlefield condition.

20. PINAKA Rocket system is a state of art equipment. Applications of PINAKA Rocket System in the Indian Army are as under:-

(a) **Long-Range Fire Support**. PINAKA provides critical long-range firepower to neutralize enemy positions, troop concentrations, and supply lines up to 75 km.

(b) **Counter-Battery Operations**. It is highly effective in targeting enemy artillery and rocket launchers, ensuring swift suppression of hostile fire.

(c) **Precision Strikes**. The guided version enables precise targeting of high-value enemy assets like bunkers, radar stations, and command posts.

(d) **High-Altitude and Extreme Terrain Warfare**. PINAKA's adaptability makes it suitable for operations in challenging terrains, including Ladakh and the deserts of Rajasthan.

(e) **Mobility and Shoot-and-Scoot Capability**. Mounted on a mobile platform, it supports rapid deployment and quick relocation to evade enemy counterfire.

(f) **Force Multiplier**. With diverse warheads, including high-explosive, cluster, and anti-tank munitions, it significantly enhances operational flexibility.

(g) **Suppression of Enemy Air Defence (SEAD)**. PINAKA aids in clearing enemy air defence systems, enabling safe aerial operations.

FEATURES	SPECIFICATIONS
RANGE	MarkI-40km Mark II-60km
WEIGHT	15 tons (launcher)
AMMUNITION TYPE	214 mm Unguided Rkts.
RATE OF FIRE	Fires 12 Rkts in 44 Sec

DID YOU KNOW?

- The system is named after the bow of Lord Shiva, symbolizing its immense power and precision.
- Its ability to target multiple locations simultaneously, PINAKA can suppress large enemy formations and infrastructure in a single barrage.
- Despite being a land-based system, PINAKA can operate in amphibious warfare scenarios, thanks to its mobile launch platform.

PART III: AAD SYSTEM & MISSILE

21. **Missile Systems in the Indian Armed Forces**. The Indian Armed Forces employ a wide range of advanced missile systems for strategic defence and combat operations. These missile systems are designed to target land, air, and sea threats with precision and speed, enhancing India's defence capabilities.

22. **Key missile systems include**:

(a) **Surface-to-Air Missiles (SAMs)**. Like the Akash and Barak-8, designed to protect airspace by targeting enemy aircraft and missiles.

(b) **Surface-to-Surface Missiles (SSMs)**. Such as the Prithvi and Agni series, which provide strategic and tactical strike capabilities against ground targets.

(c) **Anti-Tank Guided Missiles (ATGMs)**. Like the Nag missile, used to target and destroy enemy tanks and armoured vehicles.

(d) **Cruise Missiles**. The BrahMos, a supersonic cruise missile, capable of striking both land and sea targets with high precision.

FEATURE	AGNI I	AGNI II	AGNI III	AGNI IV	AGNI V
RANGE	700KM	2,000KM	3,500KM	4,000KM	5,000+KM
PAYLOAD	1,000kg (Nuclear or conventional)	1,000-1,500 kg	1,500kg	1,500kg	1,500kg
WARHAD	Nuclear Conventional	Nuclear Conventional	Nuclear Conventional	Nuclear Conventional	Nuclear Conventional
PROPELLANT	Solid Propellant	Solid Propellant	Solid Propellant	Solid Propellant	Solid Propellant
LAUNCH PLATFORM	Mobile/Truck based	Mobile/Truck based	Mobile/Truck based	Mobile/Truck based	Mobile/Truck based
GUIDANCE SYSTEM	Internal Navigation GPS	Internal Navigation GPS	Internal Navigation GPS	Internal Navigation GPS	Internal Navigation GPS
SPEED	Mach 5	Mach 5	Mach 7	Mach 7	Mach 24
INDUCTION YEAR	2000	2002	2007	2012	2015

These missile systems are integral to the Indian Armed Forces' deterrence strategy, ensuring national security and operational effectiveness.

Surface-to-Surface Missile System (SSMs)

23. **Agni Surface-to-Surface Missile System**. The Agni Missile System is a series of long-range ballistic missiles developed for India's defence. Capable of carrying conventional and nuclear warheads, it ranges from a few hundred to over 5,000 km, ensuring strategic deterrence.

24. **Prithvi Surface - to - Surface Missile System**. The Prithvi Missile System is India's first indigenously developed ballistic missile series, designed for tactical battlefield operations. It is part of the Integrated Guided Missile Development Program (IGMDP) and serves as a versatile weapon for delivering precise strikes with both conventional and nuclear warheads.

FEATURE	PRITHVI I	PRITHVI II	PRITHVI III
RANGE	150 km	250 km	350km
PAYLOAD	1,000kg (Nuclear Conventional)	500-1000kg (Nuclear Convention)	500-1000kg (Nuclear Convention)
WARHEAD	Nuclear Conventional	Nuclear Conventional	Nuclear Conventional
PROPELLANT	Liquid Propellant	Liquid Propellant	Liquid Propellant
LAUNCH PLATFORM	Mobile/Truck based	Mobile/Truck based	Mobile/truck based
GUIDANCE SYSTEM	Inertial Navigation	Inertial Navigation GPS	Inertial Navigation GPS
SPEED	Mach 5	Mach 5	Mach 5
INDUCTION YEAR	1988	2003	2004

25. **BrahMos Missile System**. The BrahMos Missile is a supersonic cruise missile jointly developed by India and Russia. It is recognized for its high speed, precision.

FEATURES	SPECIFICATION
TYPE	Supersonic cruise missile
RANGE	VERSION I RANGE: 290km VERSION II RANGE: 450km (Can vary depending on launch platform)
WEIGHT	3,000kg (Including Warhead)
AMMUNITION TYPE	Conventional warheads upto 300 kg (High explosive fragmentation)
RATE OF FIRE	N/A (Single shot, Cruise missile)
SPECIAL QUALITIES/ FEATURES	- SPEED: Mach 2.8 to Mach 3 - Highly accurate with terminal guidance - Versatile launch - Platforms (Air, Land, Sea and Submarines) - Advanced stealth technology - Quick reaction time and reduced radar detection

26. **Nirbhay Missile System**. The Nirbhay Missile is a long-range, subsonic cruise missile developed by India to provide precision strike capability in tactical and strategic scenarios. It is designed to fly at low altitudes, avoiding radar detection and enhancing survivability. It adds flexibility to India's defence strategy, complementing other missile systems with its long-range and stealth capabilities.

FEATURES	SPECIFICATIONS
Range	Up to 1,500 km, suitable for deep penetration
Capabilities	Terrain-hugging flight for stealth operations
Payload	Can carry both conventional and nuclear warheads

27. **Anti-Tank Guided Missiles (ATGMs) NAG Missile System**. The Nag Missile is an indigenously developed anti-tank guided missile (ATGM) designed to neutralize heavily armoured vehicles with precision. It is a fire-and-forget missile, capable of operating in diverse battlefield conditions.

FEATURES	SPECIFICATIONS
Range	Up to 4 km(land-based), and 7 km(air borne)
Guidance System	Advanced imaging infrared seeker for accuracy
Launch Platforms	Deployed from specially designed vehicles or helicopters
Other Features	Fire & Forget technologies, high penetration capabilities, versality, day/night capability

28. **L-70 Anti-Aircraft Gun**. The **L-70 Anti-Aircraft Gun** is a reliable, towed anti-aircraft weapon used extensively by India's Air Defence Regiments. Originally developed by Bofors, it has been modernized to meet contemporary battlefield requirements, making it effective against low-flying aerial threats like drones, helicopters, and fighter jets.

FEATURES	SPECIFICATIONS
RATE OF FIRE	Up to 300 rounds per minute (ground targets) Up to 240 rounds per minute (aerial targets)
RANGE	Up to 4 km for aerial targets
MOBILITY	Can be deployed in various locations including border and key installations
LOW ALTITUDE AIR DEFENCE	Ideal for engaging enemy helicopters and drones
CALIBER	40 mm

PART IV: UAVs & MAJOR EQUIPMENT IN INDIAN ARMY

29. **UAVs in Indian Defence Forces**. Unmanned Aerial Vehicles (UAVs), commonly known as drones, have become integral to modern warfare. The Indian Defence Forces utilize various UAVs for reconnaissance, surveillance, target acquisition, and strike capabilities, enhancing operational effectiveness in diverse terrains and conditions. They provide the Indian Defence Forces with unmatched flexibility for surveillance, intelligence

gathering, and precision strikes, playing a pivotal role in modernizing India's military operations.

KEY UAVs IN INDIAN DEFENCE FORCES

	SEARCHER MKII	**HERON**	**RUSTOM II**	**HAROP**
ROLE	Reconnaissance and surveillance	Medium-altitude long-endurance(MALE) UAV	Indigenious MALE UAV for surveillance and armed roles	Loitering munition for precision strikes
RANGE	Upto 300 km	Up to 1000km	250 km	1000+ km
ENDURANCE	16-18 hours	Over 30 hrs	24 hrs	6 hours in loitering mode
PAYLOAD	Electro-optical and infrared sensors	Electro-optical, infrared, and synthetic aperture radar	Advanced imaging systems	16kg of warhead
CAPABILITIES	Terrain-following and target tracking, suitable for high altitude operations	Real-time intelligence and target acquisition	Autonomous takeoff and landing capabilities	Directly strikes enemy targets like radars and missile sites

30. **Swathi Weapon Locating Radar (WLR)**. The Swathi Weapon Locating Radar (WLR), developed by DRDO, provides real-time enemy artillery tracking. This counter battery is designed to detect and track incoming artillery and rocket fire to determine the point of origin for counter battle fire. Manufactured by Bharat Electronics Limited,it is a key asset and showcases India's defence innovation.

FEATURES	SPECIFICATIONS
ACCURATE TARGETING	Swathi pinpoints enemy artillery, mortars and rockets for precise counter-attacks.
MULTI TARGET TRACKING	Tracks multiple projectiles in high-intensity conflicts
HIGH MOBILITY	Mounted on a rugged vehicle for rapid deployment across diverse terrains
ALL-WEATHER OPERATIONS	Functions effectively in extreme conditions, ensuring 24/7 readiness
QUICK SETUP	Becomes operational within 30 mins for rapid response

31. **Bridge Layer Tank**. The **Bridge Layer Tank (BLT)** is an essential engineering vehicle used by the Indian Army to facilitate rapid mobility across obstacles such as rivers, ditches, and other water bodies during combat operations. It is equipped with a fully operational bridge that can be deployed and retracted quickly, allowing armoured and mechanized units to cross difficult terrain with minimal delay. The BLT ensures seamless manoeuvrability of forces, providing strategic advantage during offensive and defensive operations.

FEATURES	SPECIFICATIONS
RAPID DEPLOYMENT	Deploys bridges within minutes for troop and vehicle
HEAVY LOAD	Supports tanks and heavy mechanized units
HIGH MOBILITY	Mounted on a tank chassis & operates in rough terrains
CREW PROTECTION	Armoured chasis resists small arms fire and shell fragments
INTEGRATION WITH ARMOURED UNIT	Ensures smooth movement
ALL-TERRAIN CAPABILITIES	Functions effectively in mud, sand and snow

32. **PMP&PMS Bridge System**. The **PMP and PMS Bridge Systems** are advanced modular bridges enabling quick troop and vehicle movement across water obstacles and tough terrains. Designed for rapid deployment, they enhance operational mobility and sustain combat momentum.

PARAMETERS	DETAILS
FLEXIBLE DESIGN	Modular components allow varied bridge lengths
HIGH LOAD CAPACITY	Supports tanks and mechanized units.
RAPID DEPLOYMENT	Quick assembly and dissemble for swift crossings
TERRAIN ADAPTABILITY	Functions on rivers, canals and uneven ground
EASY TRANSPORT	Moves easily via trucks and military vehicles
DURABLE BUILD	Corrosion resistant for long term use
COMBAT INTEGRATION	Supports tactical maneuver and unit mobility

33. **Differences between PMP and PMS**. The major differences between PMP and PMS is shown in tabulated form below.

	PMP BRIDGE SYSTEM	PMS BRIDGE SYSTEM
BRIDGE LENGTH	Up to 60 meters	Up to 100 meters
LOAD CAPACITY	Supports up to 60 tons	Supports mechanized Infantry and tanks
DEPLOYMENT TIME	Approximately 2-3 hours	2 hours under ideal conditions

34. **Advanced Light Helicopter (ALH) DHRUV**. The **Advanced Light Helicopter (ALH) Dhruv** is an indigenously designed and manufactured multi-role helicopter developed by Hindustan Aeronautics Limited (HAL). It serves as a versatile platform in the Indian Armed Forces, supporting a wide range of operations, including transport, reconnaissance, search and rescue, casualty evacuation, and combat missions. Known for its adaptability, Dhruv has become a critical asset across all branches of India's defence forces.

PARAMETERS	DETAILS
VERSATILE ROLES	Used for troop transport, logistics, medical evacuation and anti-insurgency
HIGH CAPACITY	Carries upto 4 troops or equivalent cargo
CUSTOMIZABLE	Available in military, naval and coast guard versions, armed or unarmed
RESCUE OPERATIONS	Deployment for disaster relief, search and aid transport
COMBAT-READY	Armed variants feature machine guns, rocket pods and anti-tank missiles
CRUISING SPEED	250 km/hr
RANGE	Up to 630km
PAYLOAD	1,500kg of cargo or 14 personnel

CONCLUSION

35. India has the fourth most powerful military in the world with strong Army, Navy and Air Force, India's defence budget for Financial Year 2025-26 was approx. 79 billion dollars. It is imperative that India maintained a strong Defence Force as India has volatile neighbouring countries. To keep them at bay it is imperative that our country maintains state of art weapons and equipment.

36. With government focussing on "Aatm Nirbhar Bharat", indigenous defence production has substantially grown. Project like MBT Arjun and Tejas Mk I have been a huge success wherein not only have been inducted in Armed Forces but also have been exported to foreign nations.

SUMMARY

- **Tanks & Infantry Fighting Vehicles (IFVs)**
  - T-90 Bhishma: Russian-origin MBT with a 125mm gun, advanced sensors, and ERA armour, effective in varied terrains.
  - MBT Arjun: Indigenous third-gen MBT with a 120mm rifled gun, compos ite armour, and advanced fire control.
  - BMP-2 IFV: Amphibious Soviet-designed vehicle with a 30mm cannon, anti-tank missiles, and machine guns.
- **Artillery & Rocket Systems**
  - 150mm BOFORS Gun: Long-range fire support with high-explosive and armour-piercing capabilities.
  - Pinaka MBRL: Indigenous rocket launcher with a 75 km range, used for saturation and precision strikes.
- **Missile Systems**
  - Agni Series: Long-range ballistic missiles for nuclear and conventional deterrence.
  - Prithvi Series: Short-range ballistic missiles for tactical operations with high precision.

- BrahMos Cruise Missile: Supersonic, multi-platform missile with a 600 km range.
- Nag ATGM: Fire-and-forget anti-tank missile for land and air platforms.

➢ **Air Defence & Surveillance**

- L-70 Anti-Aircraft Gun: Upgraded system with radar and electro-optical targeting.
- Swathi Radar: Tracks enemy artillery and rockets up to 50 km for counter-battery fire.

➢ **Unmanned Aerial Vehicles (UAVs)**

- Heron: Long-endurance surveillance UAV with a 30-hour flight time.
- Searcher Mk II: Tactical UAV for intelligence gathering with a 300 km range.
- Harop: Loitering munition for precision strikes on radar and missile systems.

➢ **Engineering & Mobility Systems**

- BLT: Deploys 60-ton capacity bridges for mechanized units.
- PMP & PMS Bridges: Modular systems for crossing difficult terrains.

➢ **Advanced Light Helicopter (ALH) Dhruv**

- Multi-role HAL-developed helicopter for transport, evacuation, and combat.
- Operates in high-altitude and adverse conditions with a 1,500 kg payload.

ASSESSMENT EXERCISE

Multiple Choice Questions (MCQs)

Q1. What is the primary role of the BMP-2 Infantry Fighting Vehicle?

(a) Air defence
(b) Infantry transport and fire support
(c) Long-range artillery
(d) Missile launching

Q2. Which system uses Kanchan composite armour?

(a) T-90 Bhishma
(b) MBT Arjun
(c) BMP-2
(d) Pinaka

Q3. What is the maximum range of the Pinaka Mark-II system?

(a) 40 km
(b) 60 km
(c) 75 km
(d) 90 km

Q4. What type of missile is the BrahMos?

(a) Ballistic
(b) Cruise
(c) Surface-to-air
(d) Anti-tank

Q5 What is the main armament of the T-90 Bhishma tank?

(a) 105mm rifled gun
(b) 120mm smoothbore gun
(c) 125mm smoothbore gun
(d) 130mm cannon

Q6. Which missile system is used for nuclear deterrence?

(a) BrahMos (b) Pinaka
(c) Agni (d) Nag

Q7. What is the operational range of the Swathi Weapon Locating Radar for detecting artillery?

(a) 30 km
(b) 40 km
(c) 50 km
(d) 60 km

Q8. Which UAV is used for loitering munitions in the Indian Army?

(a) Heron
(b) Rustom-II
(c) Harop
(d) Searcher Mk II

Q9. What is the deployment time for the Bridge Layer Tank (BLT)?

(a) 2–3 hours
(b) 10–15 minutes
(c) 5–10 minutes
(d) 20–30 minutes

Q10. Which system is equipped with the Shtora-1 defensive technology?

(a) MBT Arjun
(b) T-90 Bhishma
(c) BMP-2
(d) Pinaka

Q11. Which system in the Indian Army can fire 12 rockets in 44 seconds?

(a) Agni
(b) Pinaka
(c) Prithvi
(d) BrahMos

Q12. What is the main role of the Bridge Layer Tank (BLT)?

(a) Air defence
(b) Transporting Infantry
(c) Facilitating obstacle crossing
(d) Launching missiles

Q13. The Nag missile is designed for which specific purpose?

(a) Anti-aircraft operations
(b) Anti-tank operations
(c) Reconnaissance
(d) Strategic deterrence

Q14. What is the primary role of the Swathi Weapon Locating Radar?

(a) Detecting low-flying aircraft
(b) Locating enemy artillery
(c) Guiding UAVs
(d) Tracking ballistic missiles

Q15. Which missile system is capable of loitering before striking its target?

(a) Nirbhay
(b) Harop
(c) BrahMos
(d) Nag

Q16. What is the maximum operational altitude of the Advanced Light Helicopter Dhruv?

(a) 15,000 feet
(b) 18,000 feet
(c) 20,000 feet
(d) 25,000 feet

Q17. Which anti-aircraft gun system is extensively used by India’s Air Defence Regiments?

(a) L-70
(b) ZU-23
(c) Akash SAM
(d) Barak-8

Q18. What is the key advantage of the BMP-2 over traditional APCs (Armoured Personnel Carriers)?

(a) Higher troop capacity
(b) Heavy artillery capabilities
(c) Armament for independent fire support
(d) Greater speed in water

Q19. Which UAV is primarily used for medium-altitude, long-endurance missions in the Indian Army?

(a) Rustom-II
(b) Searcher Mk II
(c) Heron
(d) Harop

Q20. What is the propulsion system of the BrahMos missile?

(a) Solid fuel
(b) Liquid fuel
(c) Solid and liquid fuel propulsion
(d) Ramjet engine

Short Answer Questions

Q1. What is the primary use of the Pinaka system?

Q2. Name two features of the MBT Arjun.

Q3. What role does the Swathi Weapon Locating Radar play?

Q4. What is the range of the BrahMos missile?

Q5. What is the main role of the BMP-2 in the Indian Army?

Long Answer Questions

Q1. Discuss the operational role and features of the MBT Arjun in the Indian Army.

Q2. Explain the significance of the Pinaka MBRL system in modern warfare.

Q3. Describe the role of UAVs in the Indian Army with examples.

Q4. What are the features and operational importance of the Swathi Weapon Locating Radar?

Q5. Compare the roles of the Agni and Prithvi missile systems in India's defence strategy

MWE –III: MODERN TRENDS IN WPN SYSTEMS & AMMUNITION (SD SW)

“BrahMos and Sudarshan are not just Weapons; They are Symbols of India’s Journey From Ancient Strategy to Modern Supremacy”

विजयः संयुगे सत्यं, बलं विज्ञानसंयुतम्। *(Valmiki Ramayana, Aranya Kanda)*

“Victory in battle is assured when strength is united with knowledge.”

TEACHING INSTRUCTIONS

Period	**:**	**02 (80 Mins)**
Type	**:**	**Lecture**
Year	**:**	**Third Year SD/SW**
Conducting Officer	**:**	**Permanent Instructor**

Training Aids: Class Room, OHP, Board and Chalk/ Markers

Time Plan

- **Introduction : 03 Mins**
- **Part - I : 37 Mins**
- **Part - II : 35 Mins**
- **Conclusion : 05 Mins**

INTRODUCTION

1. Imagine a battlefield where lasers disable enemy drones, robots clear landmines, soldiers use augmented reality headsets to navigate terrains, and drones silently hover over targets before striking with precision. This is not science fiction, it is the reality of modern warfare, shaped by groundbreaking advancements in military technology. For NCC cadets, understanding these technologies opens a window to the future of defence, showcasing how nations prepare to protect their sovereignty in an increasingly complex world.

2. The Indian Armed Forces, with a commitment to self-reliance, are rapidly adopting and developing such advanced systems. From directed energy weapons to AI-based situational awareness tools, these innovations enhance combat efficiency, reduce risks, and ensure informed decision-making. This session introduces these transformative technologies, highlighting their applications, advantages, and India-specific initiatives, giving cadets an exciting and insightful glimpse into the future of military operations.

INTERESTING FACTS

- **Laser Shields and Drone Hunters**: Did you know that lasers can act as shields? Directed energy weapons, like those being developed by the Indian Armed Forces, can instantly destroy enemy drones or missiles mid-air, protecting sensitive installations.
- **Robots in Combat**: Imagine robots clearing minefields or carrying supplies in rough terrains. The Indian Army already uses robots like Daksh for bomb disposal, paving the way for autonomous combat units in the future.
- **Augmented Reality on the Battlefield**: Soldiers are now equipped with wearable headsets that provide real-time 3D maps and enemy positions, almost like a video game but in real life. These technologies are being tested for use in Indian defence operations.

LEARNING OBJECTIVES

- Familiarize cadets with advanced military technologies and their applications.
- Develop an understanding of India-specific future inductions in defence technology.
- Inspire awareness about emerging trends in modern warfare.

PREVIEW

- Part I: Advanced Military Technologies
- Part II: Emerging Technologies & Future Inductions

PART-I: MODERN TRENDS IN WPN SYSTEMS & AMN

3. **Directed Energy Weapons**. Directed Energy Weapons (DEWs) use focused energy beams such as lasers or microwaves to disable targets with high precision. These weapons have the advantage of silent and invisible operation, reducing collateral damage and the cost per engagement. The Defence Research and Development Organisation (DRDO) in India has been working on DEWs, including the "Durga II" laser weapon system, intended to counter Unmanned Aerial Vehicles (UAVs) and other airborne threats.

SPECIFICATIONS	
MODEL OF DEVELOPMENT	Durga II (laser-based DEW)
EFFECTIVE RANGE	Typically, 1-2 km for current DEW prototypes
ENERGY SOURCE	High-power electricity or advanced batteries
TARGETING SYSTEM	Line-of-sight precision, allowing accurate engagement of moving targets
DEPLOYMENT PLATFORM	Intended for ground and vehicle-based platforms
Features and Capabilities	
• Silent Engagement: Ideal for covert operations, minimizing detection risks. • Minimal Collateral Damage: Targets specific threats without affecting nearby areas. • Cost Efficiency: Minimal operational costs per use once deployed. • Adaptable Use Cases: Effective against drones, UAVs, and electronic systems.	
Applications	
• Countering drones and missiles by neutralizing them mid-flight. • Disabling electronic systems and surveillance equipment. • Protecting sensitive installations from aerial threats.	

4. **Precision Guided Munitions**. Precision Guided Munitions (PGMs) enable the Indian Armed Forces to conduct targeted strikes with minimal collateral damage. Equipped with advanced guidance systems like GPS and LASER targeting, PGMs ensure that strikes are accurate and lethal. The Indian Air Force and Army use systems like the Spice 2000 and Sudharshan Laser-Guided Bomb, providing accurate air-to-ground strike capabilities.

SPECIFICATIONS	
TYPES IN SERVICE	Spice 2000, Sudharshan Laser-Guided Bomb
GUIDANCE SYSTEM	GPS, laser, and infrared systems for precision
ACCURACY	Within a 1-meter radius
RANGE	Between 10 to 50 km, depending on the system
WARHEAD TYPES	Includes high-explosive, cluster munitions, and bunker buster options
Features and Capabilities	
➢ High Precision Targeting: Capable of hitting exact locations with minimal error. ➢ Versatile Munition Types: Adaptable for different mission needs from anti-vehicle to anti-infrastructure. ➢ Day and Night Operations: Equipped to function effectively in all light conditions. ➢ Operational Versatility: Used for various tactical scenarios, including counter-terrorism and anti-infrastructure missions	
India's Use	
➢ Sudarshan laser-guided bombs for precision airstrikes. ➢ HELINA (Helicopter-Launched Nag Missile) for anti-tank operations. ➢ Smart Anti-Airfield Weapon (SAAW) for precision targeting of enemy runways.	

5. **Loitering Munitions**. Loitering munitions, such as the Harop drones acquired by the Indian Armed Forces, combine drone and missile technologies to deliver precision strikes on high-value targets. These munitions can hover over a target area, waiting for the ideal opportunity to strike. Loitering munitions are particularly effective in time-sensitive missions where instant engagement is critical.

SPECIFICATIONS	
TYPE IN SERVICE	Harop Loitering Munition
ENDURANCE	Capable of loitering for up to 6 hours
RANGE	Effective up to 40 kilometers
WARHEAD TYPE	High-explosive payload
TARGETING SYSTEM	Electro-optical and infrared sensors
Features and Capabilities	

- Real-Time Surveillance and Attack: Provides both intelligence gathering and strike capabilities.
- Instant Target Engagement: Suitable for quick-response scenarios.
- Autonomous Operation: Capable of engaging without direct operator control once deployed.
- Versatility in Use: Effective against enemy command posts, armoured vehicles, and radar installations.
- The Indian Armed Forces currently use loitering munitions such as “Nagastra 1”, Warmat: and “ALS-50”, which have ranges of up to 50 km, to target tanks, armoured vehicles and other assets.

6. **AI-Based Situational Awareness Systems**. AI-Based Situational Awareness Systems enhance battlefield decision-making by processing real-time data from various sources. These systems help Indian Armed Forces in reconnaissance, surveillance and target acquisition (RSTA) missions, enabling them to respond effectively to dynamic threats. The Combat Information Decision Support System (CIDSS) developed by DRDO exemplifies the use of AI in situational awareness, improving intelligence analysis and threat detection.

SPECIFICATIONS	
SYSTEM IN DEVELOPMENT	CIDSS
DATA INTEGRATION	Combines satellite, drone, and ground data
AI ALGORITHMS	Utilizes deep learning and computer vision for rapid data processing
RANGE	Limited only by the network of sensors deployed
PLATFORM	Usable on ground vehicles, drones, and command centres

Features and Capabilities

- Enhanced Threat Detection: Quickly identifies and categorizes threats, reducing response time.
- Improved Tactical Decisions: Assists commanders with detailed intelligence, improving mission outcomes.
- Adapts to Battle Changes: Responds to dynamic battlefield conditions in real-time.
- Multi-Source Data Analysis: Integrates multiple data feeds for a comprehensive battlefield view.

Applications
➢ Identifying threats and predicting enemy movements ➢ Providing actionable insights for informed decision-making
Advantages
➢ Reduces casualties and ensures equipment safety ➢ Enables 24/7 monitoring of conflict zones
India's Use
➢ DRDO's Combat Information Decision Support System (CIDSS) integrates AI for enhanced battlefield awareness. ➢ AI-enabled drones and surveillance systems for real-time data processing.

7. **Military Robotics and Autonomous Systems**. Military Robotics and Autonomous Systems are a growing area of focus in India's defence landscape. With developments like the DRDO "Daksh", a robot designed for Explosive Ordnance Disposal (EOD), these systems assist in dangerous missions, minimizing life threatening risk to personnel. Robotics enhance operational capabilities in the in the fields of reconnaissance and explosive disposal.

SPECIFICATIONS	
SYSTEM IN SERVICE	Daksh EOD Robot
CAPABILITIES	Can detect and defuse IEDs and landmines
MOBILITY	Operates on rugged terrain, suitable for combat zones
CONTROL RANGE	Operable remotely within a range of 500 meters
PAYLOAD CAPACITY	Equipped with tools for EOD operations

Features and Capabilities
➢ Reduces Soldier Casualties: Takes on high-risk tasks to protect personnel. ➢ Versatile Mission Support: From reconnaissance to bomb disposal. ➢ Remote Control Capability: Allows operators to manage operations safely from a distance. ➢ Adaptable in Varied Terrains: Designed to operate in rugged and hazardous environments.
Advantages
➢ Minimizes human exposure to dangerous environments. ➢ Increases operational efficiency in challenging terrains.
India's Use
➢ Daksh robot developed by DRDO for bomb disposal. ➢ Exoskeleton prototypes being tested for enhancing soldier endurance.

8. **INTERNET OF MILITARY THINGS (IoMT)**. The Internet of Military Things (IoMT) enables a cohesive, interconnected network of assets, providing a real-time operational picture. Through IoMT, the Indian Armed Forces aim to enhance battlefield awareness and decision-making. DRDO is working on integrating IoMT with systems like UAVs, tanks, and command centers, improving coordination and efficiency.

TACTICAL COMMUNICATION SSTEM

BATTLE FIELD SURVILLANCE SYSTEM

SPECIFICATIONS	
OPERATIONAL SCOPE	Network of sensors, communication devices and control systems.
DATA TRANSMISSION	Real-time data sharing across units.
COVERAGE RANGE	Variable, extending across battle zones through secure networks.
PLATFORM COMPATIBILITY	Operable remotely within a range of 500 meters.
PAYLOAD CAPACITY	Usable on drones, ground vehicles, ships, and command centres.

Features and Capabilities
➢ Real-Time Connectivity: Enables synchronized operations across all units. ➢ Improved Situational Awareness: Provides up-to-date battlefield information. ➢ Enhanced Decision Support: Facilitates quick response to threats. ➢ Cyber-Resilient: Designed to withstand cyber threats and maintain data integrity.
Advantages
➢ Improves decision-making with a unified command network. ➢ Reduces response time during critical missions.
India's Use
➢ Tactical Communication Systems (TCS) and Battlefield Management Systems (BMS) focus on IoMT integration for real-time command and control

9. **Cyber Warfare**. Cyber warfare capabilities are critical in contemporary military operations. They encompass offensive and defensive measures to attack and protect digital infrastructure. Offensive capabilities, such as malware and ransomware, can disrupt enemy networks, while defensive strategies, like firewalls and intrusion detection systems, shield sensitive information and maintain operational integrity.

SPECIFICATIONS
➢ Offensive Tools: Malware, ransomware, phishing attacks, denial-of-service (DoS) attacks. ➢ Defensive Tools: Firewalls, intrusion detection systems (IDS), data encryption. ➢ Integration: Coordinated with intelligence and cyber command units. ➢ Capabilities: Offensive and defensive measures for network integrity, data security, and operational safety. ➢ Threat Detection: Advanced analytics and AI-powered threat detection. ➢ Capability to infiltrate enemy networks and disable critical infrastructure. ➢ Defensive systems to protect military databases and communications. ➢ Advanced encryption for securing data transmission.

➢ AI-driven threat detection and response. ➢ Constant monitoring for proactive defence against cyber threats.
Offensive Capabilities
➢ Deploying malware and ransomware to disable enemy systems. ➢ Phishing attacks to disrupt enemy communications.
Defensive Strategies
➢ Advanced firewalls and intrusion detection systems to protect sensitive data. ➢ Secure communication protocols for military operations.
India's Efforts
➢ Indigenous cybersecurity frameworks by DRDO and CERT-In. ➢ Development of Netra, an internet surveillance system.

10. **Additive Manufacturing**. Additive manufacturing, commonly known as 3D printing, has emerged as a valuable technology in military logistics and production. It allows for on-demand production of essential parts, reducing logistical demands and enabling rapid prototyping of new equipment. This technology also opens possibilities for creating advanced materials, such as self-healing Armour and temperature-controlled clothing for soldiers.

SPECIFICATIONS	
TECHNOLOGY	3D printing (metal and polymer-based)
APPLICATIONS	Ammunition, spare parts, equipment, clothing
MATERIALS	Metal alloys, thermoplastics, high-strength polymers
CAPABILITIES	Customization, rapid prototyping, localized production
ADVANTAGES	Cost-effectiveness, reduced logistical strain, enhanced adaptability
Features and Capabilities	
➢ Reduces the need for large stockpiles by enabling on-demand production. ➢ Capable of creating specialized ammunition and military gear. ➢ Supports innovative materials like self-healing armour and temperature-regulated clothing. ➢ Allows for localized manufacturing, decreasing dependence on supply chains. ➢ Facilitates repair and maintenance by producing replacement parts in the field.	

Applications
➢ Localized production of spare parts and equipment. ➢ Creation of self-healing armour and lightweight materials.
Advantages
➢ Improves decision-making with a unified command network. ➢ Reduces response time during critical missions.
India's Use
➢ Reduces production costs and time. ➢ Enables on-demand manufacturing in remote areas.

PART II: EMERGING TECHNOLOGIES AND FUTURE INDUCTIONS

11. The evolution of modern warfare necessitates continuous innovation in weapon systems to address emerging threats and enhance battlefield effectiveness. Conceptualized weapon systems represent the cutting edge of defence technology, encompassing ideas and designs that are either under development in prototype stages or undergoing trials.

12. These systems are conceptualized to meet specific operational requirements, such as improving precision, range and survivability or integrating advanced technologies like Artificial Intelligence, robotics and directed energy. They often focus on addressing future warfare scenarios, including network-centric operations, asymmetric threats and high-intensity conflicts.

13. Through rigorous testing and iterative improvements, these prototypes are refined to deliver superior performance and reliability. Once successful, these systems pave the way for the next generation of weapons shaping the future of military capabilities and strategy.

14. **FRCV (Future-Ready Combat Vehicle)**. The Future-Ready Combat Vehicle (FRCV) is an initiative by the Indian Army to replace the ageing T-72 tank fleet which has been the backbone of India's armoured capabilities for decades. With the modern battlefield becoming increasingly complex and technologically advanced, there is a need for a tank that can match global standards in terms of firepower, mobility, and protection. The FRCV program is focused on developing a next-generation main battle tank (MBT) with improved capabilities to face contemporary threats.

SPECIFICATIONS	
ARMOUR	Composite and modular Armour with additional active protection systems.
FIREPOWER	Advanced main gun with enhanced penetration capabilities and support for guided munitions.
MOBILITY	High-speed, all-terrain capability with a powerful engine for quick deployment.
ELECTRONICS	Equipped with digital fire control systems, AI-driven threat detection, and night vision.
CREW	3-person crew with enhanced ergonomic design for operational efficiency.

Features and Capabilities
➢ Enhanced Protection: Multi-layered Armour with modular components allows for adaptability against varied threats. ➢ Improved Firepower: Capable of firing high-velocity shells and guided missiles, increasing its range and accuracy. ➢ Advanced Mobility: Equipped with a powerful engine and enhanced suspension for rough terrains and fast mobilization. ➢ Automation: Integration of AI systems for situational awareness and targeting, reducing human error. ➢ Examples in Use: The FRCV is intended to surpass current T-90 tanks in performance, positioning India on par with international tank platforms like the U.S. Abraham and the German Leopard 2.

15. **ATAGS (Advanced Towed Artillery Gun System)**. The Advanced Towed Artillery Gun System (ATAGS) is an indigenous project to upgrade India's artillery capabilities by replacing old howitzers. Developed by the Defence Research and Development Organisation (DRDO) in collaboration with private firms, ATAGS is designed to provide long-range, accurate, and effective artillery support to ground forces.

SPECIFICATIONS	
CALIBER	155 mm, 52-caliber barrel
RANGE	Capable of firing up to 48 kilometers depending on ammunition type
MOBILITY	Designed for rapid deployment with towability across varied terrains
AUTOMATION	Semi-automated ammunition loading system for faster firing rates
WEIGHT	Approximately 18 tons, suitable for transportation by military trucks
EXTENDED RANGE	ATAGS has one of the longest ranges in its class, allowing for effective coverage of extensive battlefield

HIGH RATE OF FIRE	The semi-automated loading system enables quick firing, crucial for sustained artillery bombardment
ACCURACY AND RELIABILITY	Advanced fire control systems ensure high precision and durability.
INDIGENOUS DESIGN	Boosts India's self-reliance in defence manufacturing, with all components developed domestically.
EXAMPLES IN USE	Once fully operational, ATAGS will replace the existing Bofors howitzers, significantly enhancing India's artillery reach and firepower.

16. **CADET (Carrier Air Defence Tracked System)**. CADET (Carrier Air Defence Tracked System) is a self-propelled air defence system intended to protect armoured columns from aerial threats. Integrated with India's 'Akashteer' Air Defence Control and Reporting System, CADET offers an effective mobile shield against enemy aircraft, drones, and missiles. This system is essential for the Indian Army's future mechanized warfare, providing close air defence support for moving troops.

SPECIFICATIONS	
WEAPONRY	Equipped with short-range surface-to-air missiles (SAMs)
MOBILITY	Tracked system designed to keep pace with armoured divisions
INTEGRATION	Linked with Akashteer AD system for real-time air threat information
RADAR	On-board radar with a 360-degree tracking capability
CREW	Operated by a small crew with automated firing and targeting systems.
Features and Capabilities	
➢ Mobile Air Defence: Provides defence for advancing forces against low-flying aircraft and UAVs. ➢ Real-Time Targeting: Integration with Akashteer allows for synchronized defence with other air defence assets. ➢ Rapid Deployment: Tracked chassis enables movement in difficult terrains alongside tank regiments. ➢ Enhanced Survivability: Equipped with electronic countermeasures to resist jamming and other interference. ➢ Examples in Use: The CADET will offer India a capability similar to the Russian TOR system, providing mobile SAM support to frontline units.	

17. **Sudarshan CIWS (Close-in Weapon System)**. The Sudarshan Close-In Weapon System (CIWS) is designed as a last line of defence against incoming aerial threats such as missiles, aircraft, and drones. This system plays a crucial role in protecting high-value assets and installations by intercepting and neutralizing threats in close proximity.

SPECIFICATIONS	
WEAPONRY	Multi-barrel guns with high rate of fire.
TRACKING	Advanced radar and electro-optical tracking for precise targeting.

RANGE	Effective within a few kilometers to protect critical areas.
RESPONSE TIME	Capable of rapid response to multiple simultaneous threats.
OPERATION	Automated engagement with manual override options.
Features and Capabilities	
• Rapid-Fire Defence: Designed to neutralize close-range threats with a very high rate of fire. • 360-Degree Protection: Capable of tracking and engaging threats from any direction. • Advanced Targeting: Combines radar and optical tracking for accuracy. • Examples in Use: Like the U.S. Phalanx CIWS, the Sudarshan CIWS will enhance India's point-defence capabilities, especially around critical installations.	

18. **HAL's Prachand/Rudra Attack Helicopters**. The Hindustan Aeronautics Limited (HAL) "*Prachand"* and "*Rudra"* helicopters are indigenous attack helicopters developed to meet the Indian military's need for agile, versatile, and lethal air support. They are designed to perform both reconnaissance and combat missions, equipped with weaponry to engage ground and aerial targets.

SPECIFICATIONS	
ARMAMENT	Air-to-ground missiles, rockets, and machine guns.
AVIONICS	Advanced navigation, targeting, and surveillance systems.
RANGE	Capable of extended operational range with in-flight refueling.
CREW	Two pilots with a dual-control cockpit.
MOBILITY	Excellent manoeuvrability for high-altitude operations.
Features and Capabilities	
➢ Multi-role Capabilities: Suitable for both attack and reconnaissance missions. ➢ High-Altitude Performance: Operable in mountainous terrains, particularly in border regions. ➢ Heavy Armament: Equipped with a range of missiles and rockets for diverse combat roles. ➢ Examples in Use: Deployed along India's northern and western borders, enhancing India's air assault capabilities against both ground targets and light armoured vehicles.	

19. **MPATGM (Man-Portable Anti-Tank Guided Missile)**. The Man-Portable Anti-Tank Guided Missile (MPATGM) is India's next-generation, lightweight, and highly effective anti-tank weapon system. Designed to replace the aging '*Konkur'* and '*Milan'* systems, it empowers Infantry units with the capability to neutralize armoured threats in close-quarters and high-mobility scenarios.

SPECIFICATIONS	
RANGE	Effective up to 2.5 kilometers
GUIDANCE	Fire-and-forget with infrared homing capability
WEIGHT	Portable with minimal setup requirements
WARHEAD	Tandem warhead effective against reactive armour
DEPLOYMENT	Operable by a single soldier with minimal preparation time

Features and Capabilities

- Lightweight and Portable: Suitable for Infantry units requiring high mobility.
- Advanced Guidance System: Infrared homing for 'fire-and-forget' capability.
- Enhanced Armour Penetration: Tandem warhead penetrates even reactive armour.
- Examples in Use: Designed to give Infantry a comparable system to the American Javelin, enhancing anti-tank capabilities in high-intensity conflict scenarios.

20. **Drones and their use in Modern**. Warfare Drones have become indispensable in modern warfare, offering capabilities that enhance reconnaissance, surveillance, and strike precision. These unmanned aerial vehicles (UAVs) can operate in high-risk areas, gather real-time intelligence and in some cases execute targeted strikes. India is increasingly integrating drones into its defence strategy to improve situational awareness and reduce risk of loss of life of fighting troop.

SPECIFICATIONS	
TYPES	Reconnaissance drones, combat drones and loitering munitions.
RANGE	Varied, depending on mission type (from short-range to beyond line of sight).
PAYLOAD	Cameras, sensors, missiles, explosives.
CONTROL	Remote or autonomous navigation.
FLIGHT DURATION	Depends on model and mission requirements.

Features and Capabilities

- Real-Time Intelligence Gathering: Provides continuous monitoring of target areas
- Surveillance: Capable of high-altitude, long-duration flights for area mapping
- Precision Strike: Equipped with missiles or loitering munitions for targeted attacks
- Reduced Troop Risk: Operates in high-risk zones, minimizing casualties
- Adaptability: Suitable for reconnaissance, electronic warfare, and direct combat.

CONCLUSION

21. As the cadets have seen, technology is the future of Defence Forces in India. India has taken the foot forward and a plethora of weapons and equipment is being inducted. Be it submarines, Long and Short Range Missiles, Fifth Generation Fighter Jets or Rifles for the Infantry, the next decade will see a huge defence technology. The Defence sector manufacturing will increase manifolds with huge investments coming from the established industries in the country.

SUMMARY

Part I : Advanced Military Technologies:-

- **Directed Energy Weapons (DEWs)**.
  - Use focused energy beams like lasers or microwaves to neutralize targets with high precision.
  - Key Example: DRDO's DURGA-II, designed to counter drones and missiles.

- **Precision Guided Munitions (PGMs)**.
  - Enable targeted strikes with minimal collateral damage using advanced guidance systems (GPS, laser).
  - Key Examples: Sudarshan laser-guided bombs, HELINA missiles.

- **Loitering Munitions**.
  - Combine drone and missile technologies for real-time surveillance and precision strikes.
  - Key Example: Harop drones for destroying radar systems.

- **AI-Based Situational Awareness Systems**.
  - Utilize AI for reconnaissance, surveillance, and decision-making.
  - Key Example: DRDO's CIDSS for enhanced battlefield intelligence.

- **Military Robotics and Autonomous Systems**.
  - Robots for reconnaissance, logistics, and bomb disposal, minimizing human risk.
  - Key Example: Daksh robot for explosive ordnance disposal.

- **Internet of Military Things (IoMT)**.
  - Network of interconnected military assets for real-time battlefield awareness.
  - Key Example: Tactical Communication Systems (TCS) in India.

- **Cyber Warfare**.
  - Offensive and defensive strategies to secure digital infrastructure and disrupt enemy networks.
  - Key Example: DRDO's Netra for internet surveillance.

- **Additive Manufacturing (3D Printing)**
  - Enables localized production of military equipment, reducing logistical burdens.
  - Key Example: DRDO's hubs for rapid prototyping of military components.

Part II: Emerging Technologies and Future Inductions:-

- **FRCV (Future-Ready Combat Vehicle)**. Next-generation tank to replace T-72 with advanced mobility and firepower.

- **ATAGS (Advanced Towed Artillery Gun System)**. High-range artillery system developed indigenously.

- **CADET (Carrier Air Defence Tracked System)**. Mobile air defence system integrated with Akashteer for frontline units.

- **Sudarshan CIWS**. Close-in weapon system for neutralizing aerial threats.

- **HAL's Prachand/Rudra Helicopters**. Multi-role attack helicopters for high-altitude operations.

- **MPATGM (Man-Portable Anti-Tank Guided Missile)**. Lightweight anti-tank system with fire-and-forget capability.

- **Immersive Technologies and Augmented Realities**. Wearable devices providing real-time battlefield data and 3D terrain maps.

- **Drones in Modern Warfare**. Enhance reconnaissance, surveillance, and strike capabilities.

ASSESSMENT EXERCISE

Multiple Choice Questions (MCQs)

Q1. What is the key feature of Directed Energy Weapons (DEWs)?

(a) Use of explosives
(b) Use of focused energy beams
(c) Autonomous operation
(d) GPS-guided targeting

Q2. Which system is developed by DRDO for situational awareness?

(a) Daksh
(b) CIDSS
(c) FRCV
(d) ATAGS

Q3. What is the primary use of loitering munitions?

(a) Reconnaissance only
(b) Real-time surveillance and precision strikes
(c) Logistics support
(d) Air Defence

Q4. Which missile is a man-portable anti-tank guided weapon?

(a) BrahMos
(b) MPATGM
(c) HELINA
(d) Harop

Q5. What does IoMT stand for?

(a) Internet of Military Technologies
(b) Internet of Military Things
(c) Integrated Military Technology
(d) Intelligent Military Tracking

Q6. Which Indian-developed system is designed to replace aging T-72 tanks?

(a) ATAGS (b) FRCV
(c) Prachand (d) Rudra

Q7. What is the primary function of the Advanced Towed Artillery Gun System (ATAGS)?

(a) Anti-aircraft defence
(b) High-range artillery strikes
(c) Cybersecurity
(d) Precision bombing

Q8. Which type of ammunition combines drone and missile technologies?

(a) Precision Guided Munitions
(b) Loitering Munitions
(c) Ballistic Missiles
(d) Anti-Tank Missiles

Q9. Which of the following is NOT a feature of Internet of Military Things (IoMT)?

(a) Interconnected battlefield assets
(b) Real-time data sharing
(c) Enhances battlefield situational awareness
(d) Missile launching capability

Q10. Which drone is specifically used for reconnaissance by the Indian Army?

(a) Harop
(b) Heron
(c) Switchblade
(d) Daksh

Q11. What does the Sudarshan CIWS replace?

(a) Ballistic missiles
(b) Traditional anti-aircraft guns
(c) Armoured vehicles
(d) Artillery systems

Q12. Which robot is used for explosive ordnance disposal in India?

(a) Rustom
(b) Daksh
(c) CIDSS
(d) Prachand

Q13. What makes additive manufacturing advantageous in military applications?

(a) High-speed mobility
(b) Lightweight armour production
(c) Cost-effective and on-demand production
(d) Real-time data sharing

Q14. Which missile system is launched from helicopters?

(a) BrahMos
(b) HELINA
(c) MPATGM
(d) ATAGS

Q15. What is the full form of FRCV?

(a) Future-Ready Combat Vehicle
(b) Fully Robotic Combat Vehicle
(c) Fast Response Combat Vehicle
(d) Forward Reconnaissance Combat Vehicle

Q16. Which of the following is a Directed Energy Weapon under development in India?

(a) CIDSS
(b) DURGA-II
(c) Rudra
(d) Netra

Q17. Which system integrates AI to provide enhanced battlefield intelligence?

(a) IoMT
(b) CIDSS
(c) Daksh
(d) ATAGS

Q18. What is the primary role of MPATGM?

(a) Air defence
(b) Anti-tank operations
(c) Precision bombing
(d) Reconnaissance

Q19. What is the primary advantage of using loitering munitions in warfare?

(a) Higher troop capacity
(b) Real-time targeting with extended loitering time
(c) Enhanced armour protection
(d) Intercepting ballistic missiles

Q20. What technology provides soldiers with 3D terrain maps during combat?

(a) IoMT
(b) Augmented Reality (AR) systems
(c) Additive Manufacturing
(d) AI-based analytics

Q21. Which air defence system is integrated with Akashteer for multi-layered security?

(a) ATAGS
(b) CADET
(c) FRCV
(d) Sudarshan CIWS

Q22. Which Indian missile is capable of striking enemy runways with precision?

(a) BrahMos
(b) Smart Anti-Airfield Weapon (SAAW)
(c) Harop
(d) MPATGM

Q23. Which advanced attack helicopter is developed by HAL?

(a) Rudra
(b) Prachand
(c) Rustom-II
(d) Heron

Q24. What is the primary goal of Netra, developed by DRDO?

(a) Cyber surveillance and monitoring
(b) Missile defence
(c) Artillery support
(d) Robotic assistance

Q25. Which Indian system enhances network-centric warfare capabilities?

(a) CIDSS
(b) IoMT
(c) Tactical Communication System (TCS)
(d) Daksh

Short Answer Questions

Q1. What is the primary application of Precision Guided Munitions (PGMs)?

Q2. Name an example of a robot used by the Indian Armed Forces.

Q3. What is the role of the Sudarshan CIWS?

Q4. What is the advantage of additive manufacturing in defence?

Q5. What is DRDO's DURGA-II?

Long Answer Questions

Q1. Explain the applications and advantages of Directed Energy Weapons.

Q2. Describe the importance of AI in situational awareness for the military.

Q3. Discuss the significance of loitering munitions in modern warfare.

Q4. How is the Indian Army utilizing additive manufacturing?

Q5. Describe the role of drones in modern military operations.

ANSWER KEY

ARMED FORCES (SD/SW)

ANSWER KEYS

Q No	AF-I	AF-II	AF-III	AF-IV	AF-V	AF-VI
1.	(c)	(b)	(b)	(c)	(b)	(c)
2.	(b)	(b)	(b)	(b)	(b)	(c)
3.	(b)	(c)	(b)	(b)	(b)	(b)
4.	(a)	(b)	(a)	(a)	(c)	(b)
5.	(b)	(c)	(b)	(b)	(b)	(c)
6.	(c)	(d)	(c)	(c)	(c)	(b)
7.	(c)	(a)	(b)	(c)	(c)	(b)
8.	(b)	(d)	(c)	(b)	(a)	(b)
9.	(d)	(a)	(c)	(d)	(c)	(b)
10.	(b)	(a)	(a)	(d)	(b)	(b)
11.	(b)	(b)	(a)	(b)	(a)	(b)
12.	(b)	(b)	(b)	(b)	(b)	(a)
13.	(c)	(a)	(b)	(c)	(b)	(b)
14.	(b)	(b)	(b)	(b)	(b)	(a)
15.	(c)	(d)	(c)	(c)	(a)	(b)

FIELD CRAFT & BATTLE CRAFT

ANSWER KEYS

Q No	FCBC- I	FCBC-II	FCBC-III	FCBC-IV	FCBC- V	FCBC-VI	FCBC-VII
1.	(d)	(a)	(b)	(d)	(c)	(d)	(c)
2.	(b)	(c)	(b)	(d)	(b)	(b)	(a)
3.	(d)	(d)	(b)	(b)	(c)	(ii)	(c)
4.	(d)	(b)	not cover from fire	(c)	(d)	(a)	(d)
5.	(d)	(b)	sound, light	United	(b)	(b)	Recce patrol
6.	(a)	an important and unmistakable object	disruptive coloration and conceal-ment	Secured	Battle Noises, Need for silence	Group, Range, Indication, Target	Recce, Protec-tive
7.	(d)	22 ½	(c)	02 (two)	Smoke, Use of rope	Fire Zone	(b)
8.	(c)	Indication	Hessian Cloth, Camouflage Net	Nemier	Whistle by the Mouth, Use of Color Light	Fire Direction Order	(d)
9.	(b)	Target	Sound, Light	(a)	(b)	No move-ment without covering fire	(a)
10.	(c)	Reference Point	-	Fisher-man's knot	(b)	(c)	(a)
11.	(d)	-	-	Thumb Knot	-	(d)	(b)
12.	(a)	-	-	Bowline	-	Fire Control Orders	(d)
13.	(c)	-	-	-	-	-	(c)
14.	dead ground	-	-	-	-	-	(b)
15.	300	-	-	-	-	-	(b)

MILITARY COMMUNICATION

ANSWER KEYS

Q No	MC-I	MC-II	MC-III
1.	(c)	(d)	(d)
2.	(d)	(b)	(d)
3.	(a)	(b)	(a)
4.	(c)	(b)	(d)
5.	(c)	(c)	(a)
6.	(a)	(a)	(a)
7.	(d)	(a)	(c)
8.	(b)	(c)	(d)
9.	(a)	(a)	(d)
10.	(b)	(d)	(d)
11.	(d)	(d)	(b)
12.	(b)	(b)	(c)
13.	(d)	(c)	(a)
14.	(d)	(a)	(b)
15.	(b)	(c)	(a)

MAP READING

ANSWER KEYS

Q No.	MR I	MR II	MR III	MR IV	MR V	MR VI	MR VII	MR VIII	MR IX	MR XI	MR XII	MR XIII
1.	a	c	b	c	b	b	a	b	b	a	b	a
2.	b	a	b	b	b	c	b	a	b	b	b	b
3.	a	b	c	b	c	b	b	c	b	b	b	c
4.	d	b	c	a	c	a	a	a	a	a	a	c
5.	b	d	b	c	b	c	b	b	b	b	b	b
6.	b	c	c	d	a	c	c	a	b	c	b	b
7.	a	c	c	c	c	b	a	c	b	a	b	a
8.	b	c	b	c	b	b	b	b	b	c	b	b
9.	a	b	c	c	b	b	a	a	b	b	b	c
10.	a	c	c	b	b	b	b	c	c	b	c	b
11.	a	b	c	b	c	c	a	b	b	a	b	b
12.	d	a	b	d	b	b	b	b	b	d	b	a
13.	a	a	b	c	b	b	b	b	c	b	c	b
14.	b	a	c	d	c	c	b	c	c	c	c	b
15.	b	b	c	b	b	c	b	c	b	b	b	b

MILITARY WEAPON & EQUIPMENT

ANSWER KEYS

Q No.	MWE-I	MWE-II	MWE-III
1.	(a)	(b)	(b)
2.	(b)	(b)	(b)
3.	(b)	(c)	(b)
4.	(b)	(b)	(b)
5.	(b)	(c)	(b)
6.	(d)	(c)	(b)
7.	(c)	(c)	(b)
8.	(c)	(c)	(b)
9.	(c)	(c)	(d)
10.	(c)	(b)	(b)
11.	(b)	(b)	(b)
12.	(c)	(c)	(b)
13.	(c)	(b)	(c)
14.	(b)	(b)	(b)
15.	(d)	(b)	(a)
16.	-	(c)	(b)
17.	-	(a)	(b)
18.	-	(c)	(b)
19.	--	(c)	(b)
20.	-	(d)	(b)
21.	-	-	(b)
22.	-	-	(b)
23.	-	-	(b)
24.	-	-	(a)
25.	-	-	(c)

UNITY & DISCIPLINE

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