

## MODULE 15. GAS TURBINE ENGINE

### 15.1 Fundamentals

Potential energy, kinetic energy, Newton's laws of motion, Brayton cycle;  
The relationship between force, work, power, energy, velocity, acceleration; Constructional arrangement and operation of turbojet, turbofan, turboshaft, turboprop.

### 15.2 Engine Performance

Gross thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust, thrust horsepower, equivalent shaft horsepower, specific fuel consumption;  
Engine efficiencies;  
By-pass ratio and engine pressure ratio;  
Pressure, temperature and velocity of the gas flow;  
Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.

### 15.3 Inlet

Compressor inlet ducts  
Effects of various inlet configurations;  
Ice protection.

### 15.4 Compressors

Axial and centrifugal types;  
Constructional features and operating principles and applications;  
Fan balancing;  
Operation:  
Causes and effects of compressor stall and surge;  
Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades;  
Compressor ratio.

### 15.5 Combustion Section

Constructional features and principles of operation.

### 15.6 Turbine Section

Operation and characteristics of different turbine blade types;  
Blade to disk attachment;  
Nozzle guide vanes;  
Causes and effects of turbine blade stress and creep.

### 15.7 Exhaust

Constructional features and principles of operation;  
Convergent, divergent and variable area nozzles;  
Engine noise reduction;  
Thrust reversers.

## **15.8 Bearings and Seals**

Constructional features and principles of operation.

## **15.9 Lubricants and Fuels**

Properties and specifications;  
Fuel additives;  
Safety precautions.

## **15.10 Lubrication Systems**

System operation/lay-out and components.

## **15.11 Fuel Systems**

Operation of engine control and fuel metering systems including electronic engine control (FADEC);  
Systems lay-out and components.

## **15.12 Air Systems**

Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

## **15.13 Starting and Ignition Systems**

Operation of engine start systems and components;  
Ignition systems and components;  
Maintenance safety requirements.

## **15.14 Engine Indication Systems**

Exhaust Gas Temperature/Interstage Turbine Temperature;  
Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems;  
Oil pressure and temperature;  
Fuel pressure and flow;  
Engine speed;  
Vibration measurement and indication;  
Torque;  
Power.

## **15.15 Power Augmentation Systems**

Operation and applications;  
Water injection, water methanol;  
Afterburner systems.

## **15.16 Turbo-prop Engines**

Gas coupled/free turbine and gear coupled turbines;  
Reduction gears;

Integrated engine and propeller controls;  
Overspeed safety devices.

### **15.17 Turbo-shaft engines**

Arrangements, drive systems, reduction gearing,  
couplings, control systems.

### **15.18 Auxiliary Power Units (APUs)**

Purpose, operation, protective systems.

### **15.19 Powerplant Installation**

Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.

### **15.20 Fire Protection Systems**

Operation of detection and extinguishing systems.

### **15.21 Engine Monitoring and Ground Operation**

Procedures for starting and ground run-up;  
Interpretation of engine power output and parameters;  
Trend (including oil analysis, vibration and boroscope) monitoring;  
Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer;  
Compressor washing/cleaning;  
Foreign Object Damage.

### **15.22 Engine Storage and Preservation**

Preservation and depreservation for the engine and accessories/ systems.