

# SRINIVASAN ENGINEERING COLLEGE

## PERAMBALUR

### AE 1013 HELICOPTER MAINTENANCE

#### UNIT-I

1. Mention the color coding systems in the helicopters
  - Red & white- semi rigid rotors
  - Blue & yellow- multi bladed systems
2. What are the safeties precautions must be followed while ground handling techniques?
  - A bar must be used both for raising and lowering the wheels
  - Bar must be secured firmly
  - Avoid the slippages of the bar
  - Hands or feet never be place under the skid gear
3. What are the safeties precautions must be followed while moving the fixed wing aircraft?
  - No movement should be made without sufficient help
  - Tow must be moved slowly and evenly
  - All the rotating components must be secured
  - Tow bar turning radius must be observed
4. Mention the types of bearings
  - Ball bearings
  - Roller bearings
  - Spherical bearings
5. Mention the common defects of bearings
  - Broken or cracked rings
  - Dented seals and shields
  - Cracked and broken seperators
  - Broken or cracked balls or rollers
  - Flaked areas on balla
  - Discoloration due to heat

- Brinelled bearings

6. What are the general procedures should be followed in the installations

- Clean shafts and bearing housing
- Clean splines, grooves and keyways
- Press bearing on straight and square
- A hand operated arbor press should be used whenever possible
- Press bearings until they are seated against the shaft or housing shoulder

7. Define Elastomeric bearing

The elastomeric bearings are sandwich type bearings, which is used for oscillating the loads where complete rotation is necessary

8. Mention the types of Elastomeric bearings

- Cylindrical bearings
- Spherical bearings
- Conical bearings

9. Write the advantages of the elastomeric bearings

- No lubrication is necessary
- No dis assembly
- No seizure is possible because of design
- Controlled stiffness may be obtained by the elastomers

10. Write the disadvantages of the elastomeric bearings

- High cost
- Size is depends upon the loads and motions required
- No longer life

## UNIT-II

1. Mention the types of rotor blades

- Wooden rotor blades
- Metal rotor blades
- Fibre glass or composite blades

2. Write the advantages of metal rotor blades

- Even distribution of stresses
- Continuous contact between mating surfaces
- Smoother contours
- Flexible joints
- Reduced weight

3. Classify the vibrations which takes place in the helicopter

- Low frequency vibrations
- High frequency vibrations
- Medium frequency vibrations

4. Define tracking

Tracking is the procedure used to check that all the blades are travelling with in the same tip path plane

5. When we need to track the helicopters

The helicopter requires tracking when the blades, heads or pitch change components of the head are replaced

6. What are methods used to determine the track on helicopters?

- Stick method
- Flag method
- Light reflector method
- Pre-track method
- Electronic or strobe method

7. Define trim tabs

Trim tabs that may be used in ground tracking, these tabs are fixed to the blade and are simply bent to change the angle of attack of the blade.

8. What is blade sweeping?

It is a procedure used after installation of new blades, head or major components of the head to obtain chordwise dynamic balance

9. What are procedures to be carried out for adjusting the chordwise balance?

- Mark the drag brace with a soft lead pencil or crayon
- Shorten the drag brace by loosening the jam nuts
- Retighten the jam nuts and operate the helicopters

10. What do you mean by dampener?

Dampener which affects the position of advancing and retreating the blade

11. Mention the types of dampeners

- Hydraulic dampener
- Multiple disk dampener
- Elastomeric dampener

12. Define mast

Mast is the attachment point of the main rotor. It is a tube that is attached to the helicopters transmissions

13. Mention the use of mast

It absorbs tension and torsion loads received from engine torque and weight of the helicopter in flight

14. Mention the attachment points of the mast

- Main rotor
- Stabilizer bar
- Dampener bracket
- Swash plate
- Transmission

15. What is mean by stabilizer bar?

If the helicopter rotor is disturbed by wind forces in a hover, the stabilizer bar tends to remain in its same plane of rotation due to gyroscopic action of rigidity

16. Mention the items which made the stabilizer bar

- Core
- Center frame
- Mixing levers
- Core plug
- Outer tube
- Weight
- Tie rod assembly

17. What is mean by swash plate

The swash plate transfers the movement of the cyclic and collective control from stationary push pull to rotating push-pull movements that are transferred to rotor system

18. What are major components for the swash plate?

- Swash plate support
- Collective sleeve
- Control plate inner ring
- Collective lever
- Swash plate thrust bearing
- Swash plate drive link

19. What are major units for flight control system?

- Collective
- Cyclic
- Push-pull tubes
- Torque tubes
- Bell cranks
- Mixture box
- Gradient unit
- Control boost

20. Write the major components of the hydraulic system of control boosts

- Hydraulic pump
- Reservoir

- Relief valve
- Filters
- Accumulators
- Actuator

21. Define control rigging

It is the maintenance procedure, usually confined to removal and replacement for items other than rod ends and bolts

22. Mention the components which are limited to removal and replacements

- Tubings
- Hoses
- Valves
- Pumps

23. What is the necessary of servo actuators

Servo actuators are installed in the system to assist the pilot in movement of the controls and for prevention of the rotor feedback

24. How many servo actuators are used and mention its descriptions?

Four servo actuators are installed in the system. Three are dual servo actuators one for collective and two for cyclic. A single small actuator is used for the tail rotor

25. What is the purpose of bell crank?

It is mainly used to change the direction with a push-pull tube, it will always change the travel of the tube

### UNIT-III

1. Define drive shaft

It is equipped with a rubber coupling to absorb torsional shock loads and is placed between the engine and the transmission

2. What is meant by engine-to-transmission coupling?

In addition to driveshaft it is used to insure that the driveshaft only carries torsional loads

3. Define clutch

The clutch is necessary to unload the engine during starting operation because the inertia required moving the rotor system would be too great

4. What is the purpose of freewheeling unit?

The purpose of this freewheeling unit will allow the engine to drive the transmission and prevent the rotor from driving the engine.

5. What is the function of sprag clutch

This clutch allows movement in only one direction by having inner and outer races which are often at the end of the drive shaft

6. Mention the role of rollers in roller unit

- Rollers are trapped between a lobed shaft and the freewheeling unit
- Rollers held in contact with the freewheeling head by a spring
- When rotation of the lobed shaft occurs from the engine, the rollers make contact with the lobed side and wedge
- Rollers change the position and make contact with the lobe heel

7. Define rotor brake

This component is used to stop the rotor on shutdown after the engine has ceased to power the rotor

8. Mention the sub drive assemblies in the transmissions

- Centrifugal clutch
- Freewheeling unit
- Two stage planetary reduction gears
- Four spiral bevel gears for accessory drives

9. Define hydraulic drive quill?

The hydraulic drive quill is driven by the accessory drive gear with the same type of arrangement of sleeve gear shaft and bearing as the other drives from the accessory drives

10. Mention the power progression of the transmission

- Crank shaft gear
- Clutch spider
- Clutch shoes
- Clutch drum
- Lower sun gear
- Lower spider pinions
- Freewheeling ring
- Lower spider

11. Mention the turns of accessory gear

- Transmission oil pump
- Hydraulic pump
- Rotor tachometer generator

12. Mention the reasons for speed reduction

- The engine produces the greatest amount of power at high rpm
- The rotor cannot operate at the high rpms because tip speed must stay subsonic and retreating blade stall

13. Mention the power progression of accessory drive gear

- Generator quill
- Hydraulic quill
- Tail rotor quill
- Fan quill



## UNIT-IV

1. Define separate air cooler

A separate oil cooler was installed that did not depend on ram airflow for cooling

2. What are the major components of the cooling assembly?

- Fan quill
- Fan
- Index plate
- Shroud
- Cylinder baffles

3. Mention the role of fan quill in cooling assembly

- Located on the forward side of the transmission, turns at a 12:1 ratio to the engine
- Transmits power from the transmission to the fan

4. What are the defects of cooling fans

The cooling fans are subject to cracks which often at the blade roots. Such cracks may be caused by operating the engine in wrong rpm ranges

5. Define turboshaft engine in helicopter

The turbine engines used in the helicopters come in various sizes from a range of 300-3000 horsepower. They are referred to shaft turbines or turboshafts

6. Mention the basic components of the turbo shaft engines

- Compressor
- Diffuser
- Combustor
- Turbine wheel or wheels
- Exhaust

7. Define torquemeter

Power output on the turbine engine is measured by a torquemeter. This device measures the force produced by the engine

8. Define tachometer

It is used to measure the rpm on a shaft turbine. If the engine is a free turbine, two tachometers are used. One tachometer is used for compressor and another for power turbine

9. Mention the components in the power output

- Torquemeter
- Tachometer
- Exhaust gas temperature indicator

10. Mention the role of guide vanes

- Straighten the airflow
- Prepare the air for the compressor
- Provides surge margin for the engines

11. What are the detrimental factors for small engine compressors

- FOD damage
- Erosion
- Nicks, scratches and blade deformation
- Dirt
- Blockage

12. Mention the items that governs the fuel flow and position the metering valve

- A temperature compensator
- A barometric pressure compensator
- An N1 governor
- An n2 governor
- A power control actuator
- A 3-D cam

13. Mention the major sections of the engines

- Air inlet section
- Compressor rotor section
- Diffuser section
- Combustion section
- Exhaust section

14. Mention the major operating systems of the engines

- Variable inlet guide vanes
- Interstage bleed system
- Anti-icing system
- Ignition system
- Fuel system
- Oil system

15. Define interstage air bleed

It improves the compressor acceleration by the automatic release of air during acceleration. This is accomplished by bleed holes around the fifth stage of compression

16. Mention the role of anti-icing system

The anti-icing system supplies hot air under pressure to prevent icing of the inlet housing and the inlet guide vanes during operations

17. What are purpose of ignition system

The purpose of ignition system is to provide high energy, medium voltage to four igniter plugs located in the combustor for starting

18. Mention the components of overspeed trip system

- Rotor pick up housing
- Magnetic pick up
- Speed control switch
- Fuel solenoid valve

19. Mention the major engine assemblies

- Compressor
- Combustion section
- Turbine
- Accessory gearbox
- Accessories

20. Mention the major accessory driven system

- Gas producer tachometer
- Fuel pump assembly
- Starter generator
- Gas producer fuel system

21. Mention the components of fuel systems

- Fuel pump assembly
- Gas producer fuel assembly
- Power turbine governor
- Accumulator and check valve
- Fuel nozzle

22. What are the functions of the twist grip?

- Mechanical control of the internal shutoff valve of the fuel control
- Govern or control rpm of the Off, Idle, and Full power ranges, with the governor in the automatic position
- Maintain steady state power conditions through all power ranges when the governors in the emergency position

23. List out any five major components of tail rotor drive shaft

- Forward shaft section
- Middle shaft section
- Aft shaft section
- Eight bearing assemblies
- One universal joint

24. What are the major components of tail rotor gear box?

- Gearbox housing
- Input sleeve
- Output shaft and front cap
- Pitch-change mechanism

25. Mention the main components of tail rotor assembly

- Blades
- Yoke
- Trunnion
- Bearing housing
- Thrust plug
- Pitch-change horn

## UNIT-V

1. Mention the causes for the misalignment

- Hard handlings
- Sudden stoppage

2. Mention the systems that comprises the airframe

- Fuel system
- Electrical system
- Environmental system

3. Define rescue hoists

The rescue hoists are most often used by civil agencies, such as police departments and fire departments. These allow the helicopter to act as a hoist platform for rescue work. It is capable of lifting comparatively light loads

4. Mention the purpose of cargo hooks

A cargo hook is used for heavy loads, such as sling loads.

5. Define yoke

The main supporting member of a semi-rigid rotor

6. Define trunnion

The part that splines to a mast or shaft to retain the rotor and provide the flapping hinge for semi rigid rotors

7. Mention the role of tail rotor gear box

Changes the tail rotor drive 90 degrees to either increase or decrease the speed of the tail rotor.

## Unit-I

1. Write short notes on basic directions of helicopter
2. Explain detail about ground handling techniques of helicopters
3. Explain in detail about types of bearings used in the helicopters

## Unit-II

1. With the neat sketches, explain in detail about rotor blades
2. Explain the procedure for rotor head maintenance
3. Explain in detail about blade alignment and static main rotor balance
4. Explain in detail about blade sweeping
5. Write briefly about the dampener maintenance
6. Write short notes on counter weight adjustment and auto rotation adjustment
7. Explain briefly about the mast
8. Explain in detail about the stabilizer bar
9. Explain in detail about swash plate maintenance
10. Explain briefly about the flight control systems

## Unit-III

1. Discuss briefly about the freewheeling units
2. Explain in detail about engine transmission couplings
3. Write briefly about driveshaft and its maintenance with neat sketches
4. Explain in detail about the role of torquemeter
5. Explain in detail about the rotor brake and mention its maintenance procedures also
6. Explain in detail about transmission techniques of the helicopters

## Unit-IV

1. Write briefly about fixed wing power plant modifications
2. Explain the installation techniques of the power plants
3. Explain the various components in turboshaft engines of the aircraft
4. Explain the maintenance techniques of the turbo shaft engines
5. Explain the major operating systems of the engine

6. Explain the major assembly systems of the engine
7. Explain in detail about major components of the tail rotor drive shaft system
8. Explain the various components of tail rotor assembly
9. Explain the various techniques of tail rotor installation
10. What are the procedures to be followed in the “Servicing”?

#### Unit-V

1. Explain in detail about fuselage maintenance
2. Explain in detail about various systems of airframe
3. Explain in detail about special purpose equipment