C–0346	Sub. Code
	91313

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

First Semester

Aircraft Maintenance Science

MATHEMATICS

(2016 onwards)

Duration: 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Find the modulus and amplitude of the complex numbers $7-5i$.

2. Simplify $\left[\sin\frac{\pi}{6}+i\cos\frac{\pi}{6}\right]^{18}$.

3. Find $\frac{\partial z}{\partial x}$ if $z=2x^2-11x^2y+3y^2$

4. What is successive differentiation with example?

5. Evaluate the integrals $\int \tan^2 x \sec^2 x\, dx$.

6. Evaluate the integrals $\int \frac{dx}{x^2+2x+5}$.

7. Expand by the binomial theorem of $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^4$.

8. What is the formula for $(x + a)^n$?

9. What is meant by differential equation?

10. Write down the working rule to solve a Clairaut's equation.

Part B $(5 \times 5 = 25)$

Answer **all** questions.

11. (a) Find the 5^{th} power of 11 using Binomial theorem.

Or

(b) Find the coefficient of x^{16} in the expansion of $(1 + x + x^2) \cdot (1 - x)^{15}$.

12. (a) Use De-Moivre's theorem to solve the equation $x^8 - x^5 + x^3 - 1 = 0$.

Or

(b) Express $\frac{\sin 6\theta}{\sin \theta}$ as a polynomial in $\cos\theta$.

13. (a) If $V = (x^2 + y^2 + z^2)^{\frac{-1}{2}}$, prove that $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} = 0$.

Or

(b) Find the n^{th} derivative of $\frac{1}{1 - 5x + 6x^2}$

14. (a) Evaluate $\int \frac{3x+1}{2x^2+x+1} dx$.

Or

(b) Evaluate $\int \sqrt{x^2+2x-8}\ dx$.

15. (a) Solve the differential equation

$y = px + ap(1-p)$.

Or

(b) Solve $p^2 + \left(x + y - \frac{2y}{x}\right)p + \left(xy + \frac{y^2}{x^2} - y - \frac{y^2}{x}\right) = 0$.

Part C $(3 \times 10 = 30)$

Answer **all** questions.

16. (a) Find :

(i) the general term

(ii) the middle term

(iii) coefficient of x^5

(iv) absolute term in the expansion of $\left[2\sqrt{x} - \frac{3}{\sqrt[3]{x}}\right]^{20}$.

Or

(b) Find the value of $(.999)^{\frac{1}{3}}$ correct to 4 decimal places.

17. (a) Expand $\sin^7\theta\cos^3\theta$ in a series of sines of multiples of θ.

Or

(b) Find the derivative of the product of the functions $f(x) = x^4$; $g(x) = \log x$ using the Lebiniz rule.

18. (a) Find the second derivative of the product of the functions x^2 and tan x using Lebiniz rule.

Or

(b) Solve : $xp^2 - 2yp + x = 0$.

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C–0349	Sub. Code
	91332

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Third Semester

Aircraft Maintenance Science

STRENGTH OF MATERIALS AND APPLIED MECHANICS

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Define dynamics.
2. Write a short note on derived units.
3. State Hooke's law
4. What is elastic limit?
5. What are types of loads?
6. What are the sign conventions for calculating shear force and bending moment in the beam?
7. Define F.O.S
8. What are the materials used in bearings?
9. What are the special fasteners used in aircraft industry.
10. What are the types of belt drives?

Part B $(5 \times 5 = 25)$

Answer **all** questions.

11. (a) Define the following:

(i) Resultant force

(ii) Time

(iii) Composition of forces

Or

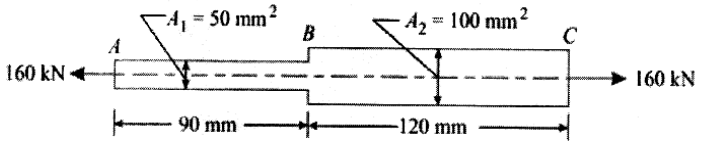
(b) Define the following:

(i) Scalar component

(ii) Vector component

(iii) Polygon law of forces

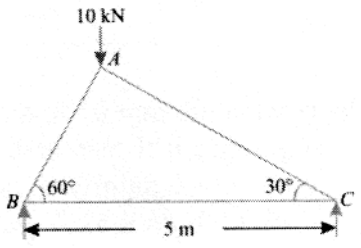
12. (a) An automobile component shown in Fig is subjected to a tensile load of 200 kN. Determine the total elongation of the component. Take E as 150 GPa.



Or

(b) A solid copper rod 290 mm long and 45 mm diameter passes axially inside a steel tube of 50mm internal diameter and 60 mm external diameter. The composite bar is tightened by using rigid washers of negligible thickness. Determine the stresses in copper rod and steel tube, when the nut is tightened so as to produce a tensile load of 100 kN in the copper rod.

13. (a) The truss ABC shown in Fig. has a span of 5 m. Find the forces in the members AB, AC and BC.



Or

(b) What is the procedure to find the slope and deflection of a beam using double integration method?

14. (a) A leaf spring is to be made of seven steel plates 65 mm wide and 6.5 mm thick. Calculate the length of the spring so that it may carry a central load of 2.75 kN, the bending stress being limited to 160 MPa. Also calculate the deflection at the center of the spring. Take E for the spring material as 190 GPa.

Or

(b) What are the common types of riveted joints?

15. (a) What is the role of belt and gear drives in aircraft industry?

Or

(b) What is the need of BIS and ISO system of threading and specifications?

Part C (3 × 10 = 30)

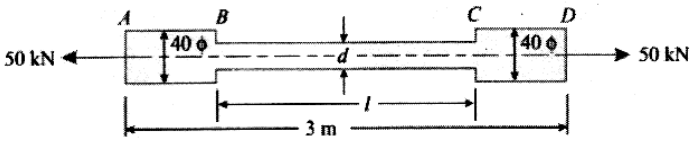
Answer **all** questions.

16. (a) A metal bar 50 mm × 50 mm in section is subjected to an axial compressive load of 500 kN. If the contraction of a 200 mm gauge length was found to be 0.5 mm and the increase in thickness 0.04 mm, find the values of young's modulus and Poisson's ratio for the bar material.

Or

(b) Derive the expression for stress and strain relationship in a two dimensional stress system.

17. (a) An alloy circular bar ABCD 3 m long and 1.7 m dia in the BC section is subjected to a tensile force of 50kN as shown in Fig. Find the total elongation of the bar. Take E as 100 GPa.



Or

(b) A closely coiled helical spring is made up of 10mm diameter steel wire having 10 coils with 80mm mean diameter. If the spring is subjected to an axial twist of 10 kN-mm, determine the bending stress and increase in the number of turns. Take E as 200 GPa.

18. (a) Explain in detail about gear drives.

Or

(b) Explain about the procedure for riveting process.

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C–0350	Sub. Code
	91333

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Third Semester

Aircraft Maintenance Science

FLUID MECHANICS AND HYDRAULIC MACHINES

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Define surface tension.

2. Define vapour pressure.

3. Define unsteady flow.

4. State assumptions used in Bernoulli's equation.

5. Explain the minor losses in the pipe.

6. What do you mean by water hammer?

7. How will you determine the loss of head due to friction?

8. What is the expression to find the force exerted by a jet of water on a moving plate?

9. Write any three application of torque converter.

10. What are the types of valves?

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) Define the following:

(i) Absolute pressure (1)

(ii) Gauge pressure (2)

(iii) Vacuum pressure (2)

Or

(b) Explain about the U-tube manometer with suitable diagram.

12. (a) (i) What are the types of fluid flow? (2)

(ii) Write a short note about Uniform and non-uniform flows. (3)

Or

(b) Derive the expression for Bernoulli's equation.

13. (a) A syphon of diameter 200mm connects two reservoirs having difference in elevation of 20 m. The length of the syphon is 500 m and the summit is 3.0 m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100 m. Determine the discharge through the syphon and also pressure at the summit. Neglect minor losses. The Co-effiecient of friction, f=0.005.

Or

(b) Find the loss of head when the pipe of diameter 200 mm is suddenly enlarged to 400 mm. The rate of flow of water through the pipe is 250 litres/second.

14. (a) A jet of water of 30mm diameter strikes a hinged square plate at its centre with a velocity of 20 m/s. The plate is deflected through an angle of 20°. Find the weight of the plate. If the plate is not allowed to swing, what will be the force requires at the lower edge of the plate to keep the plate in vertical position.

Or

(b) Write about the centrifugal pump with suitable diagram.

15. (a) Write a short note on hydraulic accumulator.

Or

(b) Write a short note on hydraulic lift.

Part C $(3 \times 10 = 30)$

Answer **all** questions.

16. (a) What is a manometer? How they are classified? Explain about any one of them with suitable diagram?

Or

(b) Derive the continuity equation.

17. (a) Derive the expression for head loss in equivalent pipes.

Or

(b) (i) What are the valve types?

(ii) How does the hydraulic and pneumatic joints prepare?

18. (a) Derive the expression for head loss in equivalent pipes.

Or

(b) The water is flowing with a velocity of 1.5 m/s in a pipe of length 2500 m and of diameter 500 mm. At the end of the pipe, a valve is provided. Find the rise in pressure if the valve is closed in 25 seconds. And at same condition if the valve is closed in 2 sec, find the rise in pressure behind the valve. Assume the pipe to be rigid one and take Bulk modulus of water $K = 19.62 \times 10^4\ N/cm^2 . C = 1460\ m/s.$

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C–0351	Sub. Code
	91334

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Third Semester

Aircraft Maintenance Science

MECHANICS OF FLIGHT AND HELICOPTER CONFIGURATION

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. What effect does temperature have on the density of the air?

2. Define Airfoil.

3. Define the term center of pressure coefficient.

4. Name some secondary control surfaces.

5. What is Hovering?

6. Define Coriolis effect.

7. What do you mean by dampener?

8. What are the major components for the swash plate?

9. Mention the reason for speed reduction in rotor systems.

10. What is the purpose of freewheeling unit?

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) Explain the meaning of the digits in the NACA four digit airfoil number.

Or

(b) Explain the terms.

(i) AR

(ii) C_D

(iii) CL

(iv) S

12. (a) What are the three primary control surfaces of an airplane? Explain.

Or

(b) How is directional stability accomplished on an aircraft?

13. (a) Explain about lift dissymmetry for a helicopter.

Or

(b) What is gyroscopic precession? Explain.

14. (a) Describe the metal rotor blades.

Or

(b) Explain in detail about the stabilizer bar.

15. (a) Write briefly about the tail rotor driveshaft with neat sketches.

Or

(b) Explain in detail about the engine transmission techniques of the helicopters.

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) What are characteristics curves of an aircraft? Explain.

Or

(b) What are the various types of drag experienced by an aircraft?

17. (a) Explain the following terms.

(i) Blade Conning.

(ii) Translational lift.

Or

(b) Define Tracking. explain any two methods used to determine the track on helicopters.

18. (a) Explain the pitch changing mechanism and its operation.

Or

(b) Explain in detail about the following control systems.

(i) The collective.

(ii) The Cyclic.

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C–0352	Sub. Code 91335

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Third Semester

Aircraft Maintenance Science

AIRCRAFT MATERIALS, HARDWARE AND NDT

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. What is the difference between the elasticity and plasticity of a material?

2. Define yield point.

3. What is meant by heat treating?

4. Define anodizing.

5. What defects in wood make them unsuitable for use?

6. What is the purpose of a close tolerance bolt?

7. What are prepregs?

8. Define fiber glass.

9. What is the principle of ultrasonic inspection?

10. What is meant by NDT?

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) Describe the composition and properties of aluminum alloy 7075-T6.

Or

(b) Write briefly on copper and its alloys.

12. (a) Write short notes on

(i) Tempering

(ii) Annealing

(iii) Quenching

Or

(b) Explain the different types of corrosion.

13. (a) What is the difference between thermosetting and thermoplastic resins?

Or

(b) Describe the self tapping screws.

14. (a) What are the advantages of composite materials?

Or

(b) What is the function of the matrix system in a laminate?

15. (a) Explain the procedure involved in Rockwell hardness test.

Or

(b) Explain briefly about Magnaflux inspection.

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) Explain SAE steel numbering system for carbon steels.

Or

(b) Explain the principle of electroplating and the process involved in it.

17. (a) Describe and explain the purpose of a blind rivet.

Or

(b) What are glues? Explain any two in detail.

18. (a) What materials may be used in honeycomb sandwich construction?

Or

(b) Explain any one standard impact testing method.

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C–0355	Sub. Code
	91351

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

Aircraft Maintenance Science

AVIATION LAW AND AIRCRAFT RULES AND REGULATIONS

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Define Aerodyne and Crew Member.

2. What is Air Worthiness advisory Circulars?

3. List out the various types of approval of organizations.

4. Define "BAMEC" and its importance.

5. What is the purpose of defect investigation?

6. Define Empty Weight.

7. Define "FDR".

8. Write the significance of IFR?

9. What is Fuel Spillage?

10. What is settling time?

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) Write the procedure for promulgation of Airworthiness authority in terms of mandatory modifications?

Or

(b) Write short notes on Aeronautical Information Circulars.

12. (a) Write the procedure for change in ownership of aircraft.

Or

(b) What are the circumstances under which duplicate AME license is issued?

13. (a) How will you send a report to regional office after completion of special flight permit?

Or

(b) List out the MEL categories.

14. (a) Write short notes of flight test report.

Or

(b) List out the requirements of medical supplies.

15. (a) What are the fuelling conditions for operator to report to fuelling company?

Or

(b) What is unusable fuel, explain the procedure to determine it?

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) What is the procedure followed for investigation of an accident as per aircraft Rules 1937?

Or

(b) What are the duties and responsibilities of chief instructor of an approved AME training institute?

17. (a) What is nationality and registration marking? Where is affixed on different types of aircraft?

Or

(b) What is aircraft log books? State different sections, requirements and preservation period for all log books?

18. (a) For issue of C of A, aircrafts are classified in certain categories. What are they? State validity of C of A in detail.

Or

(b) Write the down the procedures for Mandatory Modifications.

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C–0356	Sub. Code 91352

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

Aircraft Maintenance Science

PISTON ENGINE AND PROPELLER

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Why are reciprocating engines for aircraft called heat engine?

2. What are the positions of intake and exhaust valves during the exhaust stroke?

3. Name the principal sections of induction systems.

4. What are the advantages in turbocharging?

5. Describe lubricant.

6. Define octane number.

7. Define spark plug reach.

8. What are the three circuits present in the magneto?

9. What is the classification of the propeller?

10. Define effective pitch.

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) Write down the classification of piston engine by cylinder arrangement and displacement.

Or

(b) Write a short note on compression ratio.

12. (a) Write a short note on cooling system in engine.

Or

(b) Write a short note about turbocharger.

13. (a) What are the ice prevention procedure in the carburetor?

Or

(b) What is the need for lubrication?

14. (a) Write about the types of the magneto.

Or

(b) Write a short note on over running clutch.

15. (a) What are the forces acting on the propeller in flight?

Or

(b) Differentiate fixed pitch propeller and variable pitch propeller.

Part C

$(3 \times 10 = 30)$

Answer **all** questions.

16. (a) Write in detail about the types of the crank shaft.

Or

(b) Manifold pressure and Detonation and preignition affect the performance of the engine.

17. (a) Explain about the starter motor for reciprocating engine with suitable diagram.

Or

(b) Write in detail about the operation of the float type carburetor.

18. (a) Explain about the components of lubricating system.

Or

(b) Explain in detail about the thermal efficiency.

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C–0357	Sub. Code
	91353

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

Aircraft Maintenance Science

TURBINE ENGINE

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Write the Application of Brayton Cycle?

2. What is the role of humidity in air inlet?

3. What is turbine shroud?

4. What is importance of afterburner?

5. What are the basic requirements of turbine engine fuel system?

6. What is the purpose of fuel heater?

7. Define Specific Fuel Consumption.

8. Write the importance of wet sump lubrication system.

9. What is Hydraulic Starter?

10. Define Glow Plugs.

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) How will altitude can affect the Gas Turbine Engine Performance?

Or

(b) Write short notes on "Turbo Shaft Engine".

12. (a) What do you understand "Turbine Inlet Guide Vane"?

Or

(b) Write short notes on Engine Exhaust System.

13. (a) List out and explain various types of fuel pumps used in gas turbine engine.

Or

(b) Write short notes on Fuel Spray Nozzle.

14. (a) Explain about the role of Lubrication of Shaft and splines system.

Or

(b) Write notes on "Magnetic Plug Detector".

15. (a) Draw and explain the Time Vs starting Process of gas turbine engine.

Or

(b) Explain the Engine ignition system of gas turbine engine.

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) Discuss about the construction details of turbo propeller engine.

Or

(b) List out the factors responsible for effect of thrust variation with detail.

17. (a) Write notes on Compressor Stall.

Or

(b) List out and explain about the various types of combustion chambers used in gas turbine engine.

18. (a) Briefly explain about the Electronic Engine Control.

Or

(b) Write short notes on (i) Air Turbine Starter (ii) Hydraulic Starter.

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C–0358	Sub. Code
	91354

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

Aircraft Maintenance Science

AIRCRAFT ELECTRICAL SYSTEM

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Why Electric Energy was used in an aircraft?

2. Draw break circuit diagram.

3. What is initial charging?

4. List some batteries used in Aircraft industry.

5. How chemical reaction works in Battery?

6. What is meant by differential voltage?

7. What is auto transformer?

8. What is meant by electric load?

9. List inspection schedule for electrical system.

10. Define troubleshooting.

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) How solenoids work?

Or

(b) What are the types of solenoid valve?

12. (a) Write the constructions of Lead Acid Battery.

Or

(b) Write in detail about the types of charging.

13. (a) Briefly explain about the Synchronization of alternator.

Or

(b) What is the importance of coiling of generator?

14. (a) What is the purpose of centralized computer system?

Or

(b) Describe the operation of parallel power distribution system.

15. (a) In which electrical system are typically for troubleshooting for Ammeter.

Or

(b) What is meant by the expression troubleshooting form the flight deck?

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) Explain the procedure and principal of Circuit protection devices fuses.

Or

(b) Explain in detail about the maintenance procedure of Batteries.

17. (a) Describe about three pile regulators.

Or

(b) Explain in detail about the built in test equipment troubleshooting.

18. (a) Explain the basic principles of a variable speed constant frequency electric power system.

Or

(b) Describe the procedure for reconditioning a nickel cadmium battery.

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C–0359	Sub. Code 91355

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

Aircraft Maintenance Science

LOGISTICS AND AIR CARGO MANAGEMENT

(2016 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. What are the components of logistics?

2. Write the advantages logistics.

3. What is warehousing?

4. What is inbound logistics?

5. What is most important document for shipping globally?

6. Define TQM.

7. What is SLI in air cargo?

8. What is air cargo?

9. What is cargo handling process?

10. What are the facilities in air cargo?

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) What are the models of inventory management?

Or

(b) Write the difference between MRP and DRP.

12. (a) Explain Deregulation and government rule in logistics management.

Or

(b) Explain the importance of packaging in logistics.

13. (a) Explain the steps to implementing the quality management system.

Or

(b) Explain total quantity management.

14. (a) What type of transport is used to carry perishable?

Or

(b) Explain the regulations for perishable cargo handling.

15. (a) Write a short note on cargo aircraft handling.

Or

(b) State the importance of cargo terminals at airport.

Part C (3 × 10 = 30)

Answer **all** questions.

16. (a) Explain about sustainable inventory management for environmental impact in logistics.

Or

(b) Explain Deregulation and government rule in logistics management.

17. (a) Explain the role of warehousing and its importance, benefits in logistics.

Or

(b) Explain the global supply chain management in post pandemic world.

18. (a) Explain the types of rates, tariff in cargo rating.

Or

(b) Briefly discuss the cargo zone and terminal facilities at airport.

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C–1254	Sub. Code
	91313

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

First Semester

Aircraft Maintenance Science

BASIC AERODYNAMICS

(2023 onwards)

Duration: 3 Hours Maximum : 75 Marks

Section A $(10 \times 1 = 10)$

Answer **all** questions.

1. The temperature ratio at 7 km and 0 km of geometric altitude is

   (a) zero (b) 0.842

   (c) 1 (d) 0.623

2. Which of the following is the correct value for the lapse rate in the Troposphere and Stratosphere respectively under ISA conditions.

   (a) –4.5 k/km and +3 k/km

   (b) +3 k/km and –6.5 k/km

   (c) –6.5 k/km and +3 k/km

   (d) +6.5 k/km and –3 k/km

3. The purpose of camber in an airfoil is

   (a) to increase maximum drag

   (b) to increase maximum lift

   (c) to decrease maximum lift

   (d) to decrease maximum drag

4. Which of these is used as a High lift devices?
   (a) Aileron (b) Rudder
   (c) Elevator (d) Flaps

5. Which flight control provides longitudinal control?
   (a) Aileron (b) Rudder
   (c) Landing gear (d) Trim tab

6. What does an elevator do?
   (a) it generates a yaw rate
   (b) it generates a roll rate
   (c) it generates roll
   (d) it generates pitch

7. Longitudinal stability means ————————.
   (a) stability about pitching axis
   (b) stability about yawing axis
   (c) stability about Lateral axis
   (d) stability about negative yawing axis

8. An aircraft with Aerodynamic Centre (A.C.) forward of aircraft's Centre of Gravity (C.G.) is ————————.
   (a) Statically stable
   (b) Statically unstable
   (c) Neutral
   (d) None of these

9. What is the value of speed of sound at sea level in dry air approximately?
   (a) 340 meters per second
   (b) 300 meters per second
   (c) 343 meters per second
   (d) 350 meters per second

10. When it is appropriate to apply incompressible flow assumptions in aerodynamics?
   (a) at supersonic speeds
   (b) at subsonic speeds
   (c) at hypersonic speeds
   (d) at transonic speeds

Section B (5 × 5 = 25)

Answer **all** questions.

11. (a) Distinguish between Troposphere and Stratosphere.

Or

(b) Explain the relationship between temperature and altitude with neat graph.

12. (a) What are vortices and how they formed around aircraft wings?

Or

(b) Explain the terms :

(i) Centre of pressure

(ii) Mean Aerodynamic chord.

13. (a) Discuss the primary control surfaces of an aircraft.

Or

(b) What are spoilers, and how they do differ from other control surfaces?

14. (a) Discuss the role of the vertical stabilizer, rudder and other aerodynamic features in ensuring directional stability.

Or

(b) Write short notes on "Dutch roll stability".

15. (a) Explain the role of shockwaves in the formation of shock drag.

Or

(b) Describe the behaviour of an airplane during a shock stall.

Section C (5 × 8 = 40)

Answer **all** questions.

16. (a) Explain the structure of atmosphere by dividing into different layers.

Or

(b) Calculate the pressure ratio at 7 km and 0 km.

17. (a) What causes induced drag and how does it relate to an aircraft's life?

Or

(b) Discuss the effect of the aspect ratio of a wing on aircraft performance.

18. (a) Explain the importance of yaw control in aircraft maneuverability.

Or

(b) Explain the terms :

(i) maneuverability

(ii) climbing.

19. (a) Explain the criteria for lateral static stability.

Or

(b) Explain the concept of spiral stability.

20. (a) Discuss the importance of critical mach number.

Or

(b) Derive an expression for speed of sound.

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C–1255	Sub. Code
	91315

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

First Semester

Aircraft Maintenance Science

MATHEMATICS

(2023 onwards)

Duration : 3 Hours Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** questions.

1. A square matrix B is diagonalizable, if it is similar to _____.

   (a) identify matrix (b) null matrix
   (c) triangular matrix (d) diagonal matrix

2. The solution of the system of linear equations $x + y = 2, 4x + y = 6$ is _____.

   (a) $\left(-\frac{4}{3}, \frac{2}{3}\right)$ (b) $\left(\frac{4}{3}, \frac{-2}{3}\right)$

   (c) $\left(\frac{4}{3}, \frac{2}{3}\right)$ (d) $(1, 2)$

3. The sum of the direction cosines of Z - axis is _____

   (a) 0 (b) $\frac{1}{3}$

   (c) 1 (d) 3

4. A line makes an angle α, β, γ with the x, y and z axes. Then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is ————————.

(a) 1 (b) 2

(c) 0 (d) None of these

5. The envelope of the family of tangents to the curve $y^2 = x$ is ————————.

(a) $x^2 + y^2 = 0$ (b) $x^2 = y$

(c) $x^2 + y = 0$ (d) $y^2 - x = 0$

6. The locus of center of curvature is called ————————.

(a) Involute (b) Envelope

(c) Evolute (d) Radius of curvature

7. If $U = e^{xyz}$, then $\frac{\partial^3 y}{\partial x \partial y \partial z}$ at (1, 1, 1) is ————————.

(a) 5e (b) 3e

(c) 2e (d) 4e

8. For the two functions $f(x,y) = x^3 - 3xy^2$ and $g(x,y) = 3x^2y - y^3$ which one of the following options is correct?

(a) $\frac{\partial f}{\partial x} = \frac{\partial g}{\partial x}$

(b) $\frac{\partial f}{\partial x} = \frac{\partial g}{\partial y}$

(c) $\frac{\partial f}{\partial y} = \frac{-\partial g}{\partial x}$

(d) $\frac{\partial f}{\partial y} = \frac{\partial g}{\partial x}$

9. What is the basis for PERT analysis?

(a) An optimistic time

(b) a pessimistic period of time

(c) The date that is most likely

(d) All options mentioned above

10. What is the name of the task performance in CPM?

(a) Dummy

(b) Occasion

(c) Exertion contract

(d) None

Part B (5 × 5 = 25)

Answer **all** questions.

11. (a) If $\lambda_1, \lambda_2, ...\lambda_n$ are the eigen values of A, find the eigen values of $(A - \lambda I)^2$.

Or

(b) Verify that $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ satisfies its own characteristic equation.

12. (a) Find the equation of the tangent planes to the sphere $x^2 + y^2 + z^2 - 2x - 4y - 6z - 2 = 0$ which one parallel to the planes $2x - y + 2z + 1 = 0$.

Or

(b) Show that the lines $\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$ and $\frac{x+1}{-1} = \frac{y-z}{2} = \frac{z-5}{5}$ are coplanar.

13. (a) Find the evolute of the parabola $x^2 = 4ay$ as the envelope of normals.

Or

(b) Find the envelope of $(x-\alpha)^2 + (y-\alpha)^2 = 2\alpha$.

14. (a) If $u = (x-y)^4 + (y-z)^4 + (z-x)^4$, show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.

Or

(b) Find $\frac{dy}{dx}$ if $x^3 + y^3 = 3axy$.

15. (a) What are the rules for drawing network diagram? Also mention the common errors that occur in drawing networks.

Or

(b) What are the uses of PERT and CPM?

Part C $(5 \times 8 = 40)$

Answer **all** questions.

16. (a) Verify Cayley - Hamilton theorem and hence find inverse for $\begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$.

Or

(b) Find the eigen values and eigen vectors of $A = \begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{pmatrix}$.

17. (a) Determine the shortest distance between two skewlines in the following equations $\vec{r} = \vec{a}_1 + \lambda\vec{b}_1$ and $\vec{r} = \vec{a}_2 + \mu\,\vec{b}_2$.

Or

(b) Find the angle between the pair of lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$.

18. (a) Find δ for the curve $x^3 + y^3 = 3axy$ at $\left(\frac{3a}{2}, \frac{3a}{2}\right)$.

Or

(b) Find the center and circle of curvature of the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at $\left(\frac{a}{4}, \frac{b}{4}\right)$.

19. (a) Find $\frac{dy}{dx}$ if $u = \sin\left(x^2 + y^2\right)$, where $a^2x^2 + b^2y^2 = c^2$.

Or

(b) If $z = u^2 + v^2, x = u^2 - v^2, y = vu$, find $\frac{\partial z}{\partial x}$.

20. (a) Explain following terms :

(i) Earliest time

(ii) Latest time.

(iii) Events lack

(iv) Critical path.

Or

(b) Determine the early and date start in respect of all node points and identify critical path for the following network.