**Ph.D. COMMON ENTRANCE TEST**

**SUBJECT – AEROSPACE ENGINEERING**

**Roll No:**

**PART B**

**Duration: 60 minutes Maximum Marks: 50**

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| **Instructions:**1. **This entrance test question paper is not to be taken out of the examination hall**
2. **Question paper consists of Section A and Section B**
3. **Section A consists of 30 MCQs carrying 1 Mark each. Write the Alphabet of the correct answer in the space given.**
4. **Section B consists of Descriptive questions carrying 5 marks each. Restrict your answer to 500 words. Additional plain sheets have been attached to the question paper to answer Section B**
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**SECTION – A**

**Answer the following questions by writing the Alphabet of the correct answer in the Box given: 30 X 1 = 30**

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|  | Incompressible flow means,A. Density is constant.B. Density is not constant.C. Pressure is constant.D. Pressure is not constant.  |
|  | Two flows are *kinematically similar* when the velocities at corresponding points are: A. in the same direction.B. differ only by a constant scale factor.C. in the same direction and differ only by a constant scale factor.D. none of the above.  |
|  | Which force is dominant in a boundary layer which develops over a flat plate? A. Pressure forceB. Capillary forceC. Viscous forceD. Surface tension  |
|  | Velocity potential exists if the flow is A. IrrotationalB. InviscidC. Both A and B togetherD. None of the above  |
|  | For subsonic flows, the pitching moment coefficient Cm at quarter chord point A. Increase with increase in αB. Decreases with increase in αC. Does not change with α D. None of the above  |
|  | Based on thin airfoil theory, Clα value for flat plate is A. 2πB. πC. 2/πD. π/2  |
|  |  Mach number is the ratio of A. flow speed to local sonic speed.B. viscous force to inertia force.C. pressure force to inertia force.D. local sonic speed to flow speed.  |
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|  | The static pressure of flow across a normal shock, A. increasesB. decreasesC. remains constantD. first decreases, then increases gradually  |
|  | The static temperature of flow across the expansion fan which is generated by sharp corner, A. increasesB. decreasesC. remains constantD. first increases, then decreases gradually  |
|  | For a positively cambered airfoil, the lift coefficient Cl, at α=0 isA. Greater than 0B. Less than 0C. Equal to 0D. Undefined  |
|  | The altitude at which maximum rate of climb equal to zero is defined asA. Absolute ceiling B. Service ceilingC. Maneuver pointD. Stall point  |
|  | Load factor is defined as the ratio of A. Lift to WeightB. Weight to LiftC. Thrust to WeightD. Thrust to Drag  |
|  | Which one of the following is correct for the use of flaps in airplane A. Flaps are used to increase stall velocity (Vstall)B. Flaps are used to increase the maximum limit of coefficient of lift (Cl,max)C. Flaps are used to decrease dragD. All of the above  |
|  | Which one of the following is correct for the use of spoiler in airplane A. When spoilers are actuated, lift is destroyed over the wingB. Spoiler are used to increase thrustC. Spoiler are used during take-off to reduce dragD. Spoiler are used during take-off to increase lift  |
|  | A rocket has a thrust coefficient of 1.8, an effective jet velocity of 2500 m/s and a propellant mass flow rate of 8.0 kg/s. The initial mass of the vehicle is 4000 kg. The theoretical thrust for this rocket is A. 26 kNB. 31 kNC. 36 kND. 41 kN  |
|  | A cycle consisting of two constant pressure and two isentropic processes is A. Carnot cycleB. Otto cycleC. Stirling cycleD. Brayton cycle  |
|  | Removing the cowl from the fan in an aircraft turbofan engine gives us A. Turboprop engineB. Turbojet engineC. Ramjet engineD. Turboshaft engine  |
|  | Which of the following is NOT true for an axial-flow compressor? A. Blades are arranged in same manner as in reaction turbineB. Impeller and diffuser are used to control the mass flow rate in the compressorC. Flow of air is along the axis of compressorD. Velocity of air changes when it passes through the blades  |
|  | An optimum solid rocket propulsion system has a chamber pressure of 2.5 MPa, nozzle throat diameter of 120 mm with the propellant mass flow of 8.2 kg/s and flight velocity of 880 m/s. It is capable of producing a thrust of 20 kN. Calculate the specific impulse of the engine A. 192 sB. 228 sC. 249 sD. 333 s  |
|  | Identify the reason behind choosing a high air-fuel ratio in a gas turbine engine A. To increase the outputB. To increase the efficiencyC. To save fuelD. To reduce the exit temperature  |
|  | For a ductile material, the permanent set will be A. 0.5%B. 2%C. 3%D. ≤1%  |
|  | The Euler’s formula for critical load of a column with one end fixed and other end hinged is A. π2EI/4L2B. π2EI/2L2C. π2EI/3L2D. π2EI/L2  |
|  | Among the Tresca and Von-Mises failure theories, the conservative theory is A. TrescaB. Von-MisesC. BothD. None  |
|  | For a truss if m = 2j-r, m > 2j-r and m < 2j-r, it implies the truss is A. Redundant, Stable and DeficientB. Stable, Deficient and RedundantC. Stable, Redundant and DeficientD. None of the above  |
|  | Which of the following relations is true for effective spring constant when springs are connected parallel? (where K = spring stiffness) A. Ke = K1 + K2B. (1 / Ke) = (1/K1) + (1/ K2)C. Ke = (1/K1) + (1/ K2)D. None of the above  |
|  | If a system vibrates due to initial disturbance only, it is called -------- vibration.A. NaturalB. FreeC. ForcedD. Random  |
|  | What are the common types of damping? A. Coulomb and material hysteresisB. Material hysteresis and structuralC. Coulomb, material hysteresis and structuralD. None of the above  |
|  | What happens to the energy dissipated by damping? A. Converted into magnetic fieldB. Converted in to electric fieldC. Converted in to electromagnetic fieldD. Converted into heat  |
|  | When the speed of a turbine is 6000 rpm, it takes -------- seconds for the turbine to complete one revolution A. 0.01B. 0.1C. 0.001D. 1.0  |
|  | The damped natural frequency ωd can be expressed in terms of the undamped natural frequency ωn as 1. $ω\_{d}=ω\_{n}\sqrt{1−ζ^{2}}$
2. $ω\_{n}=ω\_{d}\sqrt{1−ζ^{2}}$
3. $ω\_{d}=ω\_{n}\sqrt{ζ^{2}−1}$
4. $ω\_{n}=ω\_{d}\sqrt{ζ^{2}−1}$
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**Section - B**

**Answer any four questions (Each question carry 5 marks) 4\*5 = 20**

1. A manometer is used to measure the pressure of a gas in a tank. The manometer fluid used has a specific gravity of 0.85, and the manometer column height is 55 cm, as shown in figure. If the local atmospheric pressure is 96 kPa, determine the absolute pressure within the tank.



2. Define stagnation pressure. At a point in an airflow the pressure, temperature, and velocity are 1 atm, 320 K, and 1000 m/s. Calculate the stagnation temperature at this point. Use (Cp)air = 1.005 kJ/kg-K and (CV)air = 0.718 kJ/kg-K.

3. List four ways to reduce liftoff distance (SLO). If weight is doubled, what will happen to SLO?

4. Differentiate between airbreathing propulsion and non-air breathing propulsion. Define by-pass-ratio of a turbofan engine and draw the schematic of the high bypass ratio turbofan engine and label its parts.

5. Determine the Euler buckling equation for a critical load of columns with both ends are pinned.

6. What are the loads acting on structural components of the aircraft? Draw the neat sketches.

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