JGI JAIN DEEMED-TO-BE UNIVERSITY | FACULTY OF ENGINEERING AND TECHNOLOGY

Department of Aerospace Engineering

Ph.D. Entrance Examination Syllabus - 2022

Aerospace Structures

Special features of Aerospace Structures, Free body diagram, the concepts of equilibrium and compatibility conditions, Airy's stress function. Loads on aircraft. Constitutive relations for 3D, 2D and 1D structures. Statically determinate and indeterminate structures. Energy Methods. Two-dimensional fields with Plane stress and plain strain idealizations.

Thin plates, buckling of thin plates, Thin-walled single and multi-cell, open and closed sections under combined bending and torsional loads.

Concept of shear center, Sheet-stiffener combinations. The concept of effective width in sheet–stringer combinations. Typical academic exercise of design of aircraft wing, fuselage, ribs in the wing, fuselage frames Example of a wing and fuselage design. Euler buckling of columns. Influence of various boundary conditions on the buckling stress in both columns and panels.

Free and forced vibrations of undamped and damped SDOF systems, Free Vibrations of undamped 2-DOF systems.

Aerodynamics and Flight Mechanics

Aerodynamics – Definitions & Nomenclature: Lift, Drag, Centre of pressure. Types of flows.

Stream line, streak line and path line. Governing Equations for Fluid flows Bernoulli's equation.

Equation for stream line, rotational & irrotational flow, circulation and vorticity. Potential Flow Theory- Elementary Flows and their combinations.

Kutta-Joukowski theorem, Kutta's condition. Concepts of Thin airfoil theory. Introduction to Finite Wing Theory- Elliptic Wing Loading, bound and trailing vortices, induced angle of attack & induced drag.

Concepts of Compressible Flows One-dimensional Compressible Flow Equations, Speed of Sound and Isentropic Relations, Forms of Energy Equations. Properties of Normal and Oblique Shock. Supersonic flow through variable area ducts.

Properties of Atmosphere, drag polar of an Aircraft, Thrust and power required, minimum & maximum speed, minimum thrust and power required and estimation of corresponding speeds

Range and endurance estimation for jet & propeller driven engines. Climbing performance

Propulsion

Basic principles of thermodynamics, conservation laws, heat engines, Otto cycle, Brayton cycle; working principle of gas turbine engine, characteristics of turboprop, turbofan, turbojet, ramjet and scramjet, cycle analysis, performance parameters and performance analysis.

Working principle and design parameters of subsonic inlets and supersonic inlets.

Working principle of subsonic and supersonic nozzle, working principle of axial compressor, centrifugal compressor, reaction turbines & impulse turbines.

Working principle of rocket engines, solid propellant rockets, liquid propellant rockets and multistaging.