BAS403

Model Question Paper with effect from 2022-2023 (NEP CBSE Scheme)

USN | | | | | | | | | | |

Fourth Semester B.E. Degree Examination

Aerospace Propulsion

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**

Q.No		Module-01	*Bloom's Taxonomy Level	Marks
1	a)	Briefly explain the principles of aircraft propulsion and Classify the different types of aircraft power plants.	L2	8
	b)	Derive the thrust equation for an air-breathing engine with a single exhaust jet using control volume approach	L2	8
	c)	Define (i) SFC (ii) TSFC (iii) Thermal Efficiency (iv) Propulsive Efficiency.	L1	4
OR				
2	a)	Explain in detail about the Thrust augmentation methods	L2	8
	b)	With a neat sketch explain the working of a Turbo-Prop Engine	L2	6
	c)	An aircraft propeller flies at a speed of 450 kmph. The diameter of the propeller is 4.1m and the speed ratio is 0.79. The ambient conditions of air the flight altitude are T=255K and ρ = 0.55 bar. Find the following i) Thrust ii) Thrust Power iii) Propulsion efficiency	L3	6
Module-02				
3	a)	Explain in detail about propeller momentum theory for positive thrust with neat sketch	L2	10
	b)	List the factors affecting performance of propeller and discuss briefly about them	L2	6
	c)	Mention the different types of power losses in propeller	L1	4
OR				
4	a)	With neat sketch, derive the necessary relation for propeller blade element theory	L2	12
	b)	List the different types of propellers and explain in brief	L2	8
Module-03				
5	a)	Derive a relation for minimum area ratio in terms of external deceleration and co-efficient of pressure.	L2	12
	b)	Explain the concept of shock swallowing by area variation in supersonic inlets	L2	8
OR				
6	a)	Discuss in detail about the performance of C-D nozzle under varying backpressures with neat sketch and	L3	8

		Explain about the under expanded, over expanded, and fully expanded nozzle		
	b)	List out the important factors affecting the combustion chamber design.	**L1**	**6**
	c)	Discuss in detail about the three different types combustion chambers	**L2**	**6**
Module-04				
7	**a)**	Derive the stage pressure ratio of a axial flow compressor and define the terms (i) stage loading coefficient (ii) flow loading coefficient	**L2**	**8**
	b)	An axial flow air compressor of 50% reaction design has blades with inlet and outlet angles of 450 and 100 respectively. The Compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when the inlet static temperature is out the compressor. Assuming the value of 200m/s for blade speed find the number of stages required if the work done factor is i) Unity ii) 0.87 for all stages.	**L3**	**12**
OR				
8	**a)**	Explain in detail about the working principle of axial flow turbine and draw the velocity triangles for a typical stage	**L2**	**10**
	b)	Gas at 7 bar and 3000C expands to 3 bar in a impulse turbine stage. The nozzle angle is 700 with reference to the exit direction. The rotor blades have equal inlet and outlet angle and the stage operates with optimum blade speed ratio. Assuming that the isentropic efficiency of the nozzles is 0.9 and that the velocity at entry to the stage in negligible, deduce the blade angle used and the mass flow required for this stage to produce 75kW. Take Cp=1.15 kJ/kg K	**L3**	**10**
Module-05				
9	**a)**	Derive the thrust equation for a rocket engine under static firing	**L2**	**8**
	b)	With a neat sketch explain the working of pressure feed liquid rocket engine.	**L2**	**8**
	c)	Mention the different types of grains based on preparation and burning.	**L2**	**4**
OR				
10	**a)**	Describe the geometries of ion thrusters with neat sketch	**L2**	**08**
	b)	Develop a conceptual blueprint for an advanced ion thruster with optimized beam/plume characteristics for a specific space mission	**L2**	**12**

Model Question Paper -2

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Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module – 1	Marks	CO's	RBTL
Q.1	(a)	Explain the working of turbojet engine and its advantage and disadvantage with a neat sketch. also draw the p-v and t-s diagram of turbojet?	10	CO1	2
	(b)	What is meant by thrust? Derive the thrust equation for a general propulsion system.	10	CO1	3
		OR			
Q.2	(a)	Explain about thrust augmentation and its 3-methods?	10	CO1	2
	(b)	Explain the working principle of a turboprop engine with a neat diagram and its advantage and disadvantage?	10	CO1	3
		Module – 2			
Q.3	(a)	Explain in detail about propeller momentum theory with a neat sketch?	10	CO2	2
	(b)	Discuss briefly about the factor affecting performance of propeller?	10	CO2	3
		OR			
Q.4	(a)	Discuss about Propeller blade element theory with relation?	10	CO2	2
	(b)	Discuss the different types of propeller power losses and its equation. Also explain about axial and rotational momentum losses?	10	CO2	3
		Module – 3			
Q.5	(a)	Discuss the relation between minimum area ratio and external deceleration ratio?	10	CO2	2
	(b)	Explain about combustion chamber performance with relation?	10	CO2	3
OR					
Q.6	(a)	Discuss in detail about the classification of combustion chamber with neat sketch?	10	CO2	3
	(b)	Explain about subsonic inlet and supersonic inlet and its types?	10	CO2	3
		Module – 4			
Q.7	(a)	Derive the degree of reaction for axial flow compressor?	10	CO3	3
	(b)	Explain briefly about axial flow compressor and discuss about two spools configuration?	10	CO3	3

OR					
Q.8	**(a)**	Derive the velocity triangle for axial flow turbine?	10	CO3	1
	(b)	Explain in detail about working principle of axial flow turbine?	10	CO3	3
Module – 5					
Q.9	**(a)**	Derive the thrust equation for a rocket engine?	6	CO3	2
	(b)	Discuss in detail about electrical propulsion rocket types with neat sketch?	7	CO3	2
OR					
Q.10	**(a)**	Explain about classification of rocket based on propellent used?	7	CO3	2
	(b)	Discuss in detail about hall thrusters with neat sketch?	7	CO3	2