MANIPAL INSTITUTE OF TECHNOLOGY



(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

MAKE UP EXAMINATIONS, JUNE 2018

SUBJECT: AIRCRAFT PROPULSION [AAE 2202]

REVISED CREDIT SYSTEM (19/06/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- (Thermodynamics Data Handbook will be provided)
- **1A.** Prove that $dp = -\rho V dV$ from newton's laws of motion

04

- 1B. Explain why energy equation has to be considered when dealing with 02 compressible fluid and how is the analysis different from an incompressible fluid
- **1C.** Explain the effect of varying back pressure in a convergent-divergent nozzle **04** using a neat figure
- 2A. Derive the one dimensional steady isentropic flow equation for a nozzle. 05
- 2B. Interpret the nozzle equation and explain with neat sketch the design of 03 nozzle and diffuser at subsonic and supersonic conditions. Construct a nozzle for converting a subsonic flow to a supersonic flow
- **2C.** Basic aircraft propulsion system must serve two purposes. Explain? **02**
- **3A.** Explain with a neat sketch, the derivation of thrust of a propeller using the **05** Momentum theory.

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3B.	Describe any 4 disadvantages of a pusher propeller 0)2
3C.	Describe how helix angle is generated in a propeller. Explain how the change)3
	in forward speed and rpm effects the helix angle	
4A.	Prove that the propulsive efficiency of a turbojet can be given as $r_{p} = \frac{2\sigma}{r}$)4
	$\eta_{P} = \frac{1+\sigma}{1+\sigma}$	
4B.	A turbojet engine operates at an altitude of 10.3 km with a Mach number of 0)6
	0.82. The data for an engine is given below:	
	Stagnation temperature at the turbine inlet= 1220K	
	Stagnation temperature rise through the compressor =170 K	
	Calorific value of the fuel =42 MJ/kg; Specific Impulse = 20 s	
	Compressor efficiency = 0.75 ; Combustion chamber efficiency = 0.97	
	Exhaust nozzle efficiency =0.96; Turbine efficiency =0.83	

Evaluate: (a) air fuel ratio, (b) compressor pressure ratio, (c) turbine pressure ratio, (d) exhaust nozzle pressure ratio (e) Mach number of exhaust gas

- 5A. Describe the differences between a Turbo-prop engine and Turbofan engine 04
- **5B.** Illustrate and explain the components with a neat sketch, and working **04** principle of a Ramjet engine
- **5C.** Explain why pulsejet engine does not require a compressor and turbine **02**