

APPROVED BY DIRECTOR GENERAL OF CIVIL AVIATION, MINISTRY OF CIVIL AVIATION, GOVT OF INDIA APPROVED BY ALL MOIR OUNCIL (OR TECHNICH, EDUCATION & AFILIARED TO RAUSTHAN TECHNICH, UMPRRTT) KOTA & IKANNET TECHNICAL UNIVERSITY, BIKANER, RUIN & AMMARGED BY L IN VERMA MEMORIAL SOCIETY

DELHI ADMINISTRATION, UNDER SOCIETIES REGISTRATION ACT XXI OF 1860

Question Paper For Internal Assessment Examination (Theory) - Credit 4 / 45 /

Instructions for Students/FacultyMid Term I (Total 80 Marks, 2 HRS. Syllabus from Unit-1)

- Part A: Total number of questions to be given are ten (5 from CO1 and 5 from CO2), each carrying 2 marks and are compulsory to attend. There is no choice. They are short answer type questions (Not More Than 25 Words For both Question & Answer), no objective type or fill in the blanks. Total 20 marks.
- Part B: Total number of questions to be given are six (3 from CO1 and 3 from CO2), out of which student must answer four (2 from CO1 and 2 from CO2). They are long answer type (**Not More Than 50 Words for Question**), each carrying 5 marks. Total 20 marks.
- Part C: Total number of questions to be given are six (3 from CO1 and 3 from CO2), out of which student must answer four (2 from CO1 and 2 from CO2). They are numerical answer type / fully elaborative type (Not More Than 70 Words for Question) *, each carrying 10 marks. Total 40 marks.

Mid Term II (Total 120 Marks, 2.5 HRS., Syllabus from Unit-2)

- Part A: Total number of questions to be given are ten (5 from CO3 and 5 from CO4), each carrying 4 marks and are compulsory to attend. There is no choice. They are short answer type questions (Not More Than 25 Words For both Question & Answer), no objective type or fill in the blanks. Total 40 marks.
- Part B: Total number of questions to be given are six (3 from CO3 and 3 from CO4), out of which student has to answer four (2 from CO3 and 2 from CO4). They are long answer type (**Not More Than 50 Words for Question**), each carrying 7 marks. Total 28 marks.
- Part C: Total number of questions to be given are six (3 from CO3 and 3 from CO4), out of which student has to answer four (2 from CO3 and 2 from CO4). They are numerical answer type / fully elaborative type (Not More Than 70 Words For Question) *, each carrying 13 marks. Total 52 marks.

Mid Term III (Total 120 Marks, 2.5 HRS., Syllabus from Unit-3)

- Part A: Total number of questions to be given are ten (5 from CO5 and 5 from CO6), each carrying 4 marks and are compulsory to attend. There is no choice. They are short answer type questions (Not More Than 25 Words For both Question & Answer), no objective type or fill in the blanks. Total 40 marks.
- Part B: Total number of questions to be given are six (3 from CO5 and 3 from CO6), out of which student must answer four (2 from CO5 and 2 from CO6). They are long answer type (Not More Than 50 Words for Question), each carrying 7 marks. Total 28 marks.
- Part C: Total number of questions to be given are six (3 from CO5 and 3 from CO6), out of which student must answer four (2 from CO5 and 2 from CO6). They are numerical answer type / fully elaborative type (Not More Than 70 Words for Question) *, each carrying 13 marks. Total 52 marks.

* LIST OF ELABORATIVE THEORY QUESTION SUBJECTS: NO SUBJECT UNDER CREDIT FOUR

Instructions For Faculties:

There should be total 6 Course Outcomes (COs) for each subject.

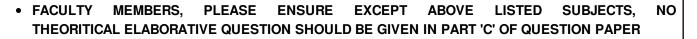
- Mid Term Question Papers are to be submitted as per Course Outcomes (COs) which should be divided equally in Part A, Part B and Part C according to Mid Term Examination and Credit Point.
- In Mid Term-1, the questions are to be given from CO1 and CO2. In Mid Term-2, the questions are to be given from CO3 and CO4. Similarly, in Mid Term-3, the questions are to be given from CO5 and CO6.

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INSTRUCTION FOR STUDENTS

 STUDENT IS ALLOWED TO ENTER LATE NOT MORE THAN 15 MIN AFTER STARTING OF EXAM, AND MAY LEAVE THE EXAM HALL ON EXPIRY OF ATLEAST OF 1 Hr FROM THE STARTING TIME OF **EXAMINATION.**

QUESTION PAPER AND STUDENTS DETAILS

Type of Exam	Mid Term 2	Date of Submission	24/07/2021
Name of Faculty	Mr. Maris Brightson	Date of Examination	27/07/2021
Course	B.Tech (Aeronautical Engineering)	Semester	SEMESTER: 4
Batch	Combined Batches 18, 19, SF 2	Subject	4 AN4 - 04 Aerodynamics-I (Cr 4)

COURSE OUTCOMES FOR REFERENCE TO FRAME QUESTION PAPER (Faculties are required to mention relevant Course Outcome number against the respective question in QP)

Course Outcome	CO3: Demonstrate Airfoil theory and its practical applications. CO4: Analyze the Thin Airfoil theory with its practical implementation.		
Email I'd	marisbrightson@soaneemrana.org	Phone No.	805-667-7643
Student Name		Student Reg No.	

Part A

All the questions are compulsory to attend.

1. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF 3 MIDTERM, AS PER INSTRUCTIONS ABOVE. **Question:1** Define Kelvin circulation theorem. Fundamentals of 15 Potential flow Theory Aerodynamics - J D Anderson Question:2 Define Karman vortex street. Fundamentals of 16 Potential flow Theory Aerodynamics - J D Anderson **Question:3** Define Cauchy-Riemann equations. Aerodynamics - L J 17 Airfoil Theory Clancy Question:4 Define conformal mapping.

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18	Airfoil Theory	Aerodynamics - L J Clancy	
Question : 5	Define complex potential function.	•	•
19	Airfoil Theory	Aerodynamics - L J Clancy	
2. CHOOSE COURSE (MIDTERM, AS PER INS	OUTCOME (CO) NUMBER ACCORD TRUCTIONS ABOVE.	ING TO THE TYPE OF	4
Question : 6	Define vortex filament.		1
23	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 7	Define vortex sheet.	•	•
23	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 8	Define zero-lift angle of attack.		
27	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 9	Define aerodynamic center.		
28	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 10	Define lift-slope.	•	•
24	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Part B	•	•	•
 FOR MIDTERM 1 - Part B: Total number of questions to be given are six (3 from CO1 and 3 from CO2), out of which student must answer four (2 from CO1 and 2 from CO2). FOR MIDTERM 2 - Part B: Total number of questions to be given are six (3 from CO3 and 3 from CO4), out of which student must answer four (2 from CO3 and 2 from CO4). FOR MIDTERM 3 - Part B: Total number of questions to be given are six (3 from CO5 and 3 from CO6), out of which student has to answer four (2 from CO5 and 2 from CO6). 			
3. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF 3			
	Explain the following		
Question : 1	(a) Kutta condition (b) Magnus effect		
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APPROVED BY ALL INDIA COUNCIL FOR TECHNICAL EDUCATION & AFRILIATES TO RAJASTHAN TECHNICAL UNIVERSITY, KOTA	RUN AND MANAGED BY LAXMI NARAIN VERMA MEMORIAL SOCIETY, REGISTERED,
& BIKANER TECHNICAL UNIVERSITY, BIKANER, RUN & MANAGED BY L N VERMA MEMORIAL SOCIETY	DELHI ADMINISTRATION, UNDER SOCIETIES REGISTRATION ACT XXI OF 1860.

16	Potential flow Theory	Fundamentals of Aerodynamics - J D Anderson		
Question : 2	Consider the lifting flow over a circular cylinder with a diameter of 0.5 m. The freestream velocity is 25 m/s, and the maximum velocity on the surface of the cylinder is 75 m/s. The freestream conditions are those for a standard altitude of 3 km. Calculate the lift per unit span on the cylinder			
17	Potential flow Theory	Fundamentals of Aerodynamics - J D Anderson		
Question : 3	Explain Karman-Trefftz profiles.			
22	Airfoil Theory	Aerodynamics - L J Clancy		
	RSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF 4			
Question : 4	Derive the fundamental equation of thin airfoil theory.			
23	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson		
Question : 5	Discuss the flow over a circular cylinde	er at various Reynolds num	bers.	
20	Potential flow Theory	Fundamentals of Aerodynamics - J D Anderson		
Question : 6	Prove that "Vortex flow is irrotational everywhere except at the point $r = 0$, where the vorticity is infinite".			
18	Potential flow Theory	Fundamentals of Aerodynamics - J D Anderson		
Question : 7 (Old Pattern)		• •		
Part C				
student must answer four FOR MIDTERM 2 - Par student must answer four FOR MIDTERM 3 - Par	 t C: Total number of questions to be g (2 from CO1 and 2 from CO2). t C: Total number of questions to be g (2 from CO3 and 2 from CO4). t C: Total number of questions to be g ur (2 from CO5 and 2 from CO6). 	iven are six (3 from CO3 a	and 3 from CO4), out of which	

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School of Aeronautics

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Question : 1	Transform circle into an ellipse by Joukowski transformation.		
20	Airfoil Theory	Aerodynamics - L J Clancy	
Question : 2	Transform circle into thin symmetrical	airfoil by Joukowski transf	ormation.
21	Airfoil Theory	Aerodynamics - L J Clancy	
Question : 3	Derive the expression for lift per unit sp	oan for a flow over a flat pla	te at some angle of incidence.
22	Airfoil Theory	Aerodynamics - L J Clancy	
6. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF 4 MIDTERM, AS PER INSTRUCTIONS ABOVE.			4
Question : 4	Consider a thin, symmetric airfoil at a 1.5° angle of attack. From the results of thin airfoil theory, calculate (a) lift coefficient, (b) moment coefficient about the leading edge, (c) moment coefficient about the quarter-chord point, and (d) moment coefficient about the trailing edge.		
24	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 5	For the NACA 2412 airfoil, the lift coefficient and moment coefficient about the quarter-chord at -6° angle of attack are -0.39 and -0.045, respectively. At 4° angle of attack, these coefficients are 0.65 and -0.037 respectively. Calculate the location of the aerodynamic center.		
27	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Question : 6	Refer Attachment		
26	Thin Airfoil Theory	Fundamentals of Aerodynamics - J D Anderson	
Upload Scanned Document In Case of Numerical or Diagram For Any of The Above Questions. (Mention question number with relevant fig / numerical / equations. Max 150 KB)		https://form.123formbuilder.com/upload_dld.php? fileid=92a0ced11cc34a4bd10f481fc3a7e273	
I have scrutinized the question paper. There is no spelling mistake or any type of irrelevant question.			
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PART – C

Question: 6

The NACA 4412 airfoil has a mean camber line given by

$$\frac{z}{c} = \begin{cases} 0.25 \left[0.8 \frac{x}{c} - \left(\frac{x}{c} \right)^2 \right] & \text{for } 0 \le \frac{x}{c} \le 0.4 \\ 0.111 \left[0.2 + 0.8 \frac{x}{c} - \left(\frac{x}{c} \right)^2 \right] & \text{for } 0.4 \le \frac{x}{c} \le 1 \end{cases}$$

Using thin airfoil theory, calculate (a) $\alpha_{L=0}$ (b) c_l when $\alpha = 3^{\circ}$