



Question Paper For Internal Assessment Examination (Theory) - Credit 4 / 38 /

Instructions for Students/Faculty Mid 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.



- FACULTY MEMBERS, PLEASE ENSURE EXCEPT ABOVE LISTED SUBJECTS, NO THEORITICAL ELABORATIVE QUESTION SHOULD BE GIVEN IN PART 'C' OF QUESTION PAPER

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 | 26/06/2021 |
| Name of Faculty | Mr. Maris Brightson | Date of Examination | 28/06/2021 |
| Course | B.Tech (Aeronautical Engineering) | Semester | SEMESTER : 6 |
| Batch | Combined Batches 15, 16, 17, SF 1 | Subject | 6 AN4 - 02 Propulsion-II (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 | CO 3. Explain the Jet Engine Compressors and its impact on aircraft propulsion system. CO 4. Analyze the Jet Engine Turbines and its working and its characteristics. | | |
| 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.

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| 1. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | 3 |
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|--------------|---|------------------------------|--|
| Question : 1 | Write the functions of the impeller and diffuser in a centrifugal compressor. | | |
| 15 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 2 | Define slip factor. | | |
| 18 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 3 | Define power input factor. | | |
| 18 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 4 | Write the functions of the stator and rotor in an axial flow compressor. | | |



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| 19 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 5 | Define work done factor. | | |
| 20 | Compressors | Gas Turbines - V. Ganesan | |
| 2. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | | | 4 |
| Question : 6 | Define flow coefficient. | | |
| 22 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 7 | Define loading coefficient. | | |
| 22 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 8 | Write the differences between impulse and reaction turbines. | | |
| 21 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 9 | Define utilization factor. Write its general expression. | | |
| 24 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 10 | Define degree of reaction. | | |
| 23 | Turbines | Gas Turbines - V. Ganesan | |

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).

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| 3. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | | | 3 |
| Question : 1 | Illustrate an enthalpy-entropy diagram for centrifugal compressors. Express the ideal and actual work done from the diagram. | | |
| 16 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 2 | Illustrate an enthalpy-entropy diagram for axial flow compressors. Express the ideal and actual work done from the diagram. | | |



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| 18 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 3 | Explain the following in detail (1) off-design operation (2) surging (3) stalling | | |
| 20 | Compressors | Gas Turbines - V. Ganesan | |
| 4. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | | | 4 |
| Question : 4 | Illustrate the velocity triangle diagram for axial flow turbines. Write the important relations. | | |
| 22 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 5 | Illustrate an enthalpy-entropy diagram for axial flow turbines. Express the ideal and actual work done from the diagram | | |
| 23 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 6 | Derive the maximum utilization factor for the single-stage impulse turbine and show the velocity triangle diagram. | | |
| 24 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 7 (Old Pattern) | | | |
| | | | |
| Part C | | | |
| <p>FOR MIDTERM 1 - 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).</p> <p>FOR MIDTERM 2 - Part C: 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).</p> <p>FOR MIDTERM 3 - Part C: 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).</p> | | | |
| 5. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | | | 3 |
| Question : 1 | Illustrate the entry and exit velocity triangle diagrams for the centrifugal compressors. Compare the results for different blade shapes. | | |
| 16 | Compressors | Gas Turbines - V. Ganesan | |
| Question : 2 | Refer Attachment | | |
| 19 | Compressors | Gas Turbines - V. Ganesan | |



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|--|--|------------------------------|---|
| Question : 3 | Refer Attachment | | |
| 19 | Compressors | Gas Turbines - V. Ganesan | |
| 6. CHOOSE COURSE OUTCOME (CO) NUMBER ACCORDING TO THE TYPE OF MIDTERM, AS PER INSTRUCTIONS ABOVE. | | | 4 |
| Question : 4 | Derive the expressions of 50% reaction stage for axial flow turbines and illustrate the enthalpy-entropy diagram & velocity triangle diagram. Find the maximum utilization factor and illustrate the velocity triangle diagram for the same. | | |
| 24 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 5 | Refer Attachment | | |
| 25 | Turbines | Gas Turbines - V. Ganesan | |
| Question : 6 | Refer Attachment | | |
| 25 | Turbines | Gas Turbines - V. Ganesan | |
| 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) | | | |
| I have scrutinized the question paper. There is no spelling mistake or any type of irrelevant question. | | | |

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PART – C

2. A centrifugal compressor has a pressure ratio of 4:1 with an isentropic efficiency of 80 % when running at 15000 rpm and inducing air at 293 K. Curved vanes at the inlet gives the air a pre-whirl of 25 degrees to the axial direction at all radii and the mean diameter of the eye is 250 mm. The absolute air velocity at the inlet is 150 m/s. The impeller tip diameter is 60 mm. calculate the slip factor.

3. An axial flow air compressor with a 50 % reaction design has blades with inlet and outlet angles of 45 and 10 degrees. The compressor is to produce the pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when inlet static temperature is 37°C. The blade speed and axial velocity are constant throughout the compressor. Assuming a value of 200 m/s for blade speed find the number of stages required if the work factor is (1) unity (2) 0.87 for all stages.

5. In a single-stage impulse turbine the nozzle discharges the fluid onto the blades at an angle of 65 degrees to the axial direction and the fluid leaves the blades with an absolute velocity of 300 m/s at an angle of 30 degrees to the axial direction. If the blades have equal inlet and outlet angles and there is no axial thrust, estimate the blade angle, power produced per Kg/s of the fluid, and stage efficiency.

6. Gas with the velocity of 240 m/s relative to the blade enters an impulse moving row at an angle of 60 degrees with respect to the axial direction. The tangential velocity of the blade is 183 /s. The work developed in the blade is estimated as 75 KJ/Kg of gas. find the blade efficiency and blade friction coefficient for relative velocities. Assume symmetrical blades.