INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	**EXPERIMENTAL AERODYNAMICS**
Course Code	:	**A72120-R15**
Class	:	**IV B. Tech I Semester**
Branch	:	**Aeronautical Engineering**
Year	:	**2018 – 2019**
Course Coordinator	:	**Mr. Shiva Prasad U, Assistant Professor , Dept. of Aeronautical Engineering**
Course Faculty	:	**Mr. Shiva Prasad U, Assistant Professor, Dept. of Aeronautical Engineering**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-I **UNIT-I** **HISTORY, MODEL TESTING & TYPES OF AERODYNAMIC EXPERIMENTS**		
1	a. Define the main objectives of aerodynamic experiments, what the consideration to be taken prior to the experiment? b. Explain the procedure of selecting model for aerodynamic observations?	Understand	1
2	a. Explain Classify various types of wind tunnel used for aerodynamic studies? b. What are the basic principles for wind tunnel selection and how the test section will neat sketches?	Remember	1
3	a. What do you mean by scaling with respect to testing in wind tunnel, is it same for all wind tunnel types or varies with speed? b. What are the scaling parameters, why it is important in aerodynamics?	Remember	1
4	a. What do you mean by dynamic scaling of model explain with a neat sketch, what are the considerations of dynamic scaling for preparing the model? b. Explain the term dynamic similarity and define the parameters of similarity?	Understand	1
5	a. Explain Buckingham pi theorem with example and define the dimensionless numbers used in experimental aerodynamics. b. Write the significance of aerodynamic experiments in comparison to numerical analysis and theoretical solution?	Remember	2
6	a. Briefly describe the method of observation for aerodynamic experiments? b. Discuss the different scaling laws used in aerodynamic modeling and differentiate between model and prototype?	Remember	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
7	a. Write the importance of scale down model and it's relation to prototype? b. What are the essential conditions to be satisfied for the results to be carried from the model to the prototype? Are there any limitations or preconditions involved?	Understand	2
8	a. Suggest the methodology on model design and related precautions? b. Write the parameters used on scaling law. Explain about geometrical similarities?	Remember	3
9	a. What are the significance of similarity parameters? Explain any one parameter and its relation with experimentation? b. Suggest some outcome from aerodynamic testing in relation to design of airplane?	Remember	3
10	a. Write the history of wind tunnel with respect to speeds over the years, give its developments? b. Discuss the classification of various types' wind tunnels based on the design in detail with illustrations?	Remember	3
UNIT- II DESIGN OF LOW SPEED WIND TUNNEL			
1	a. What is function of diffuser in wind tunnel what are the design considerations to be considered? b. What is function of effuser/contraction in design of a low speed wind tunnel, is it same for low and high speeds?	Understand	4
2	a. What is breather in a wind tunnel, what are the design considerations to be taken while designing it? b. What are the merits and demerits of open circuit wind tunnel and closed circuit wind tunnel?	Understand	4
3	a. Define Energy Ratio as per the design of the wind tunnel and define efficiency? b. Is it not feasible to have a constant area test section with a fan at the exit? Why the present day convergent-constant area- diffuser configuration has evolved?	Remember	4
4	a. Describe the sources of inaccuracies in low speed and high speed wind tunnel with illustrations? b. What is solid blockage in a wind tunnel is it same for all speeds of wind tunnel, what is percentage of blockage allowed in testing?	Remember	4
5	a. What is wake blockage, why it is important in wind tunnel testing? b. What is meant by zero lift drag, plot the graph of total drag and discuss the d Alembert principle with neat sketch?	Remember	4
6	a. What are the causes of streamline curvature in a wind tunnel testing? b. What is understood by the term low speed wind tunnel in aerodynamic testing? Describe with brief details through sketches and plots, various types of low speed wind tunnels based upon the details of the flow in test section?	Understand	5
7	a. Discuss in detail the effect of flow quality in wind tunnel performance. b. What are the components of low speed wind tunnel? Explain in detail any two of them.	Remember	5
8	a. What are the design requirements and constrictions in Low speed wind tunnels? b. Discuss about the construction of Low speed wind tunnels. Explain in detail the loss coefficients in them.	Remember	5
9	a. Illustrate with neat sketch about the boundary layer correction in the test section design of wind tunnels? b. With a neat illustration explain the objective of calibration of a wind tunnel. In	Understand	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
	WHAT way the calibration procedure for a supersonic tunnel different from that of a subsonic wind tunnel?		
10	a. Discuss the causes, estimation and correction of streamline curvature in supersonic wind tunnel design. b. Discuss in detail the wind tunnel corrections and the need for wind tunnel corrections.	Understand	6

UNIT-III
HIGH SPEED TUNNELS AND LOW SPEED WIND TUNNEL BALANCE

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	a. Mention the design considerations of transonic wind tunnel and describe the quality features of transonic wind tunnel? b. Mention the features and characteristics of wind tunnel Balance and data acquisition system?	Remember	7
2	a. Distinguish between internal and external wind tunnel balances with neat illustrations and sketches? b. Bring out the essential features of a strain gauge based Six-component internal wind tunnel balance?	Understand	7
3	a. Briefly explain how force measurements are carried out using an external strain gauge balance? b. bring the essential features of blow down wind tunnel and give advantages of Blow down type wind tunnels?	Remember	7
4	a. Discuss in detail about the shock tube wind tunnel and explain the temperature distribution in a shock tube? b. Bring out the essential features of a strain gauge based Six-component internal wind tunnel balance?	Remember	6
5	a. Present the design procedure of a blow down wind tunnel and detail the quality features and write the disadvantages of Blow down type wind tunnels? b. What are the losses in supersonic tunnel, how to reduce the losses in a supersonic wind tunnel?	Understand	6

ASSIGNMENT – II
UNIT-III
HIGH SPEED TUNNELS AND LOW SPEED WIND TUNNEL BALANCE

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	a. Briefly explain the special purpose hypersonic wind Tunnel, what are the basic requirements of hypersonic wind tunnel? b. What is meant by wind tunnel balance, give the classifications of wind tunnel test sections based on their applications?	Understand	8
2	a. With a neat illustration explain the objective of calibration of a subsonic and supersonic wind tunnel. b. In what way the calibration procedure for a supersonic tunnel different from that of a subsonic wind tunnel?	Remember	8
3	a. What are the types of wind tunnel balances, detail about the external and internal wind tunnel balances? b. Sketch the typical layout of a supersonic wind tunnel and mark all the components and subsystems. What is starting problem in supersonic tunnels?	Remember	8
4	a. What is meant by subsonic and transonic speed regime, discuss the design features of subsonic and supersonic wind tunnel?	Remember	8

S. No	Question	Blooms Taxonomy Level	Course Outcome
	b. What are the losses in supersonic tunnel?		
5	a. Compare the difference between subsonic, supersonic and hypersonic wind tunnel. b. Why a drive system is required in a wind tunnel? Why Can't the wind tunnel have a sustained flow with just a convergent- test section- diffuser arrangement?	Understand	9
UNIT-IV **PRESSURE, VELOCITY & TEMPERATURE MEASUREMENT**		
1	a. Illustrate the construction of laser Doppler velocitymetry with neat sketch. What is meant by LDA? b. What is meant by Particle Image Velocitimetry explain the technique of evaluations of the model by using this method ?	Remember	9
2	a. Explain the hot wire anemometry with an example to use in different applications? b. What is data processing of pressure, velocity and temperature measurement?	Remember	10
3	a. How pressure sensitive paints work? Explain the considerations before the method is adopted. b. Describe various pressure transducers and their concepts underlying their measurement?	Understand	10
4	a. Describe Pressure sensitive paints and their applications in analyzing the model? Name few equipment to measure Temperature. b. How the two modes of hot wire anemometry are different from each other differentiate between them?	Understand	10
5	a. Instruments used for the purpose. What are its advantages and applications? Illustrate with theory and example. b. Derive the classical equation connecting the velocity and the Doppler frequency and state the assumptions made?	Remember	11
6	a. Describe the basis for the measurement of pressure and Instruments used for the purpose. b. What are its advantages and applications of pressure measurement? Illustrate with theory and example.	Understand	12
7	a. Explain how the surface streamlines measured in wind tunnels, describe with figures and give one example? b. Explain Turbulence intensity measurements in wind tunnel test section.	Understand	12
8	a. Explain how to measure velocity of flow using LDA technique b. What is the basic principle behind hot wire anemometer? What are its limitations?	Remember	13
9	a. Explain in detail with a neat sketch about the working of a hot wire anemometer. b. Describe Particle Image Velocimetry and explain its working principle with schematics.	Understand	14
10	a. Describe the experimental setup, calibration and measurement in Particle Image Velocimetry. b. Describe various pressure transducers and their concepts underlying their measurement	Remember	13
UNIT-V **FLOW VISUALIZATION**		
1	a. Explain the classification of flow visualization Techniques explain the each technique.	Understand	14

S. No	Question	Blooms Taxonomy Level	Course Outcome
	b. What are optical flow visualization techniques and give basic principle involved in it.		
2	a. What is surface flow visualization technique and detail it with a bluff and streamlined body. b. What is data flow visualization techniques at low speeds with processor and data systems.	Remember	15
3	a. illustrate with figures and give its chemical properties of a hydrogen bubble and smoke visualization techniques? b. What is the technique adopted to visualize Shock waves?	Understand	15
4	a. What is china clay visualization, which type of flow visualization technique is this, describe? b. What are tufts, at what speeds tufts flow method is used and what are its limitations?	Remember	13
5	a. Draw a schematic of the schlieren system making use of concave mirrors marking the components and the test section b. Explain the data flow visualization techniques adopted in wind tunnel measurements can we adopt same techniques at all speeds?	Understand	12
6	a. Why the bow shock visualized through shadowgraph has bright and dark bands? b. Explain the classification of flow visualization techniques	Remember	12
7	a. Detail the flow visualization techniques with an example of each technique, and Explain the optical flow visualization technique. b. Method of flow visualization? What are the limitations of dye injection method for flow visualization?	Understand	12
8	a. Explain the data flow visualization techniques used in low speed aerodynamic wind tunnels with neat sketches. b. On what factors does the sensitivity of interferometer depend, explain in detail with the aid of sketches?	Remember	15
9	a. Explain in detail schileren technique with the aid of sketches and explain the basic principle? b. Explain in detail shadowgraph technique with the aid of neat sketches and describe the quality features of it.	Remember	15
10	a. How the imagery of schlieren and shadowgraph different in interpretation, present with a neat sketch? b. Differentiate the three optical methods schlieren, shadowgraph and interferometry and their relative advantage over each other.	Understand	15

Prepared By: Mr. Shiva Prasad U, Assistant Professor

HOD, AE