School of Aeronautics (Neemrana)

Question Paper For Internal Assessment Examination (Theory) - Old Scheme i.e 2012 Syllabus

Instructions For Students / Faculty

Mid Term I (Total 40 Marks, 1 Hr. & 30 Min, Syllabus From Beginning of The Session)

Total number of questions to be given are 8, each carrying 10 marks and it is compulsory to attend 2 questions from each part i.e. Part A and B. There is a choice of two questions out of four in each part. Part A will be theoretical or derivation type **(Not More Than 70 Words For Question).** Part B will be fully numerically oriented questions **(Not More Than 70 Words For Question)**, except for the list of subjects given below. No objective type or fill in the blanks shall be given, but subpart of question can be given for both Part A & B.

Mid Term II (Total 50 Marks, 1 Hr. & 45 Min, Syllabus From Beginning of The Session)

Total number of questions to be given are 8, each carrying 10 marks and it is compulsory to attend 2 questions from Part A and three questions from Part B. There is a choice of two questions out of four in part A and 3 questions out of 4 in Part B. Part A will be theoretical or derivation type **(Not More Than 70 Words For Question).** Part B will be fully numerically oriented questions **(Not More Than 70 Words For Question)**, except for the list of subjects given below. No objective type or fill in the blanks shall be given, but subpart of question can be given for both Part A & B.

Mid Term III (Total 60 Marks, 2 Hrs, Syllabus From Beginning of The Session)

Total number of questions to be given are 10, each carrying 10 marks and it is compulsory to attend 2 questions from Part A and 4 questions from Part B. There is a choice of two questions out of four in part A and 4 questions out of 6 in Part B. Part A will be theoretical or derivation type **(Not More Than 70 Words For Question).** Part B will be fully numerically oriented questions **(Not More Than 70 Words For Question)**, except for the list of subjects given below. No objective type or fill in the blanks shall be given, but subpart of question can be given for both Part A & B.

*** LIST OF ELABORATIVE THEORY QUESTION SUBJECTS**: Aircraft Materials, Aircraft System, Aircraft Rules & Regulation-I, Mechanics of Composite Materials, Aircraft Design, Aircraft Rules & Regulation-II, Avionics-I, Helicopter Theory, Maintenance of Airframe and System Design, Avionics-II, Airlines and Airport Management, Maintenance of Power Plant & Systems

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

STUDENT IS ALLOWED TO ENTER LATE NOT MORE THAN 15 MIN AFTER STARTING OF

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Question Paper & Student Details

Mid Term*	Mid Term 1	**Date of Submission of QP**	03/09/2019
Name of Faculty*	Dr BIPIN KUMAR DWIVEDI	**Date of Examination***	09/09/2019
Subject*	7AN4 – Aircraft Performance (Old)	**Course***	B.Tech (Aeronautical Enginee...
Batch	Combined Batches 10,11	**Semest...**	Semester : 7
Email Id of Faculty:*	bipind076@gmail.com	**Phone Number of Faculty***	931 400 9035

Student Name		**Student Reg No.**	

Part A

Question : 1* Calculate the standard atmosphere values of temperature, density and pressure at a geopotential altitude of 14 km.

Lesson Plan*	1	**Topic***	STANDARD ATMOSPHER	**Source***	INTRODUCTION T

Question : 2* If the sea level temperature and pressure is 15°C and 10,000 N/m2 respectively, whereas at same height pressure is 51000 N/m2 and the temperature is -25°C. Is the atmosphere between these two heights stable or unstable.

Lesson Plan*	1	**Topic***	STANDARD ATMOSPHER	**Source***	INTRODUCTION T

Question : 3*

Consider an airfoil in a flow of air the free stream pressure, velocity and density are 1.013 bar, 804.7 kmph and 1.23 kg/m3, respectively. At any point A on the airfoil the pressure is 0.716 bar. What is the velocity at point A?

Lesson Plan* 2 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Question : 4*

A jet transport is flying at a standard altitude of 9144 m with a velocity of 885.14 kmph. What is its Mach number?

Lesson Plan* 3 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Part B

Question : 1*

Consider an airfoil in a free stream with a velocity of 50m/s at standard sea-level conditions. At a point on the airfoil the pressure is 9.5×104 N/m2. What is the pressure coefficient at this point?

Lesson Plan* 3 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Question : 2*

Consider an airplane, which has a wing area of 15.79 m2. The weight of aircraft is 80,000N. For a flight velocity of 402 kmph at standard sea level. Calculate the lift coefficient and induced drag coefficient. Assume e=0.8.

Lesson Plan* 4 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Question : 3*

A high speed subsonic Boing 777 airliner is flying at an pressure altitude of 12km. A pitot tube on a vertical tail measures a pressure of 2.96×104 N/m2. At what Mach number is the airplane flying?

Lesson Plan* 5 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Question : 4*

An airplane is flying at an Altitude of 10 km, with a velocity of 596 m/sec. What is the pressure measured by pitot tube mounted on the nose of the airplane.

Lesson Plan* 6 **Topic*** AERODYNAMICS CHARA **Source*** INTRODUCTION T

Question : 5

Lesson Plan **Topic** **Source**

Question : 6

Lesson Plan **Topic** **Source**

Upload Scanned Document In Case of Numerical or Diagram for any of the above question

Mention question number with relevant fig / numerical / equations. Max 150 KB

Choose files or drag here

I have scrutinized the question paper. There is no spelling mistake or any type of irrelevant question.

ANSWER SHEET

7AN4 : AIRCRAFT PEFORMANCE, BATCH 10 & 11

1. At h = 19 km, T= 216.66 K, $P_0 = 101325\text{N/m}^2$, $T_0 = 288K$,

   Troposphere Lapse rate L=0.0065 K/m

   First find the values at 11000m which is gradient region or Troposphere region by using

$$\frac{P_1}{P_0} = \left(\frac{T_1}{T_0}\right)^{g_0/LR}$$

   Next find the values at 19000m, which is constant temperature region starts from 11000 m.

$$\frac{P_2}{P_1} = e^{-[g_0/RT](h_1-h_2)}$$ where, h_1=11000m, h_2=19000m

2. If the value of Lapse rate exceeds the critical value, i.e. is

   L=9.75K/Km or 0.00975k/m

$$\frac{P_1}{P_0} = \left(\frac{T_1}{T_0}\right)^{g_0/LR}$$

   Where P_0=10,000N/m^2

   P_1=51000N/m^2

   T_0=288K

   T_1=248K

3. $P_\infty = 1.013\,\text{bar}$

   $V_\infty = 804.7\,\text{km/h}$

   $\rho_\infty = 1.23\,\text{kg/m}^3$

   At any point A on the airfoil

   P = 0.716 bar

   V=?

$T_\infty = \frac{P_\infty}{P_\infty R}$ and $a_\infty = \sqrt{rRT_\infty}$

$$M_\infty = \frac{V_\infty}{a_\infty}$$

$$\frac{P}{P_\infty} = \left[\frac{1+\frac{(r-1)}{2}M_\infty^{\,2}}{1+\frac{(r-1)}{2}M^2}\right]^{r/r-1} = \left[\frac{T}{T_\infty}\right]^{\frac{r}{r-1}}$$

Obtain the value of T & M

V=M.a

$$V = M.\sqrt{rRT}$$

4. At an altitude of 9149 m. Temperature is

$$T = T_0 - LH$$

Where L = 0.0065K/m

H=9144 m

T_0=2388K

V=885.14km/h

$$M = \frac{V}{a}$$

$$a = \sqrt{rRT}$$

Section – B

1. Standard Sea level pressure $P_\infty = 10.1325\times10^4\, N/m^2$

Pressure at point A on the Airfoil $P = 9.5\times10^4\, N/m^2$

Pressure Coefficient $(C_P) = \frac{P-P_\infty}{1/2\,\rho V_\infty^2}$

Or $P_0 = P_\infty + \frac{1}{2}\rho V_\infty^2$

$$P_0 = P_\infty + \frac{1}{2}(1.23)\times(50)^2$$

$$P_0 = 10.132\times10^4 + \frac{1}{2}\times1.23\times50^2$$

$$P_0 = P + \frac{1}{2}\rho_\infty V^2$$

$$V = \sqrt{\frac{2(P_0 - P)}{\rho_\infty}} \qquad \text{and } C_P = 1-\left(\frac{V}{V_\infty}\right)^2$$

2. S = 15. 79 m^2

Weight (W) = 80,000N

$$V_\infty = 402km/h = 402\times\frac{5}{18} = 111.67m/\sec$$

$$\rho_\infty = 1.23kg/m^3$$

$$e = 0.8$$

$$b = 7.7m$$

$$AR = \frac{b^2}{S}$$

Lift force = weight of Aircraft

L=W

$$L = C_L\frac{1}{2}\rho_\infty V_\infty^2 S$$

$$80{,}000 = C_L\frac{1}{2}\times1.23\times(111.67)^2$$

Induced drag Coefficient

$$C_{pi} = \frac{{C_L}^2}{\pi rAR}$$

3. At 12000m Pressure is $P = 1.94\times10^4 N/m^2$

Pitot tube pressure $P_o = 2.96\times10^4 N/m^2$

$$\frac{P_0}{P}=\left[1+\frac{(r-1)}{2}M^2\right]^{r/r-1}$$

$$M^2=\left[\left(\frac{P_0}{P}\right)^{\frac{r-1}{r}}-1\right]\frac{2}{(r-1)}$$

$$M=\sqrt{\frac{2}{(r-1)}\left[\left(\frac{P_0}{P}\right)^{r-1/r}-1\right]}$$

4. At 10 km

T=T-LH, T=288-0.0065×10,000

T=223K

Speed of Sound $a=\sqrt{rRT}$

$$M=\frac{V}{a}$$

If $M>0.3$

$$\frac{P_0}{P}=\left[1+\frac{r-1}{2}M^2\right]^{\frac{r}{r-1}}$$

$$\frac{P}{P_1}=\left(\frac{T}{T_1}\right)^{\frac{g_0}{LR}}$$

Where $P_1=1.01325\times10^5 N/m^2$ Pressure at sea level.

$T_1=288K$ Temperature at sea level

$P_0=$ Pressure at the nose of the airplane