Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May– 2017**

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| **Code :** | **14AE2015** | **Duration :** | **3hrs** |
| **Sub. Name :** | **AIRCRAFT STABILITY AND CONTROL** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Derive the contribution of aircraft wing in staic stick fixed longitudinal Stability. | CO2 | 12 |
| b. | Derive the stick fixed Neutral point and Discuss the effect of Neutral Point in staic longitudinal Stability. | 8 |
| (OR) | | | | |
| 2. |  | The Wing-Fuselage pitching moment characteristics of High-Wing, Single Engine general Aviation airplane follow, along with pertinent Geometric data Cmcg= -0.05-0.0035α, Sw=178ft2, bw=35.9ft, Cw= 5ft, Xcg/C=0.1, ARw=7.3, Clαw=0.07/deg, iw=2deg, Clα=0=0.26.Estimate the horizontal tail area and tail incidence angle.so the complete airplane has Cmcg= 0.15-0.025α.Assume the following with regard to the horizontal tail lt= 14.5ft, ARt= 4.85ft, Clαt=0.073/deg. | CO2 | 20 |
| 3. | a. | What is Elevator effectiveness? Derive the Elevator effectiveness term. | CO2 | 10 |
| b. | What is Stick Force ? | 4 |
| c. | What is the influence of the Stick force gradient in design of control System? | 6 |
| (OR) | | | | |
| 4. |  | Given a rectangular wing of aspect ratio 6 and area 55.8 m2. The wing section employed is NACA 4412 airfoil with aerodynamic centre at 0.24 c and Cmac = -0.088.The c.g. of the wing lies on the wing chord, but 15 cm ahead of the a.c. Calculate the following.  (a) The lift coefficient for which the wing would be in equilibrium (Cmcg= 0). Is this lift coefficient useful? Is the equilibrium statically stable?  (b) Calculate the position of c.g. for equilibrium at CL = 0.4. Is this equilibrium statically stable? | CO2 | 20 |
| 5. | a. | Derive the contribution of the sweep back wing in static Longitudinal stability. | CO3 | 10 |
|  | b. | Obtain the minimum control speed in the event of an engine failure for the following airplane:  S = 65 m2, Sv = 6.5 m2, lv = 10.5 m, BHP = 880 kW (per engine), propeller efficiency = 75%, yp = 4.2 m, dCLv / dδr = 0.02 deg-1, (δr)max = 25º. | 10 |
| (OR) | | | | |
| 6. |  | Explain the following  a) Rudder requirements  b) Rudder Lock.  c) One engine inoperative condition | CO3 | 10  5  5 |
| 7. | a. | A light airplane has a wing of rectangular planform 12.8 m span, 2.14 m chord and CLmax of 1.5. The wing loading is 850 N/m2. The airplane is rolled through 450 in one second when flying at three times its stalling speed. Estimate the rolling moment created by the ailerons assuming steady motion. | CO3 | 12 |
| b. | What are the different types of Aerodynamic balancing and explain it. | 8 |
| (OR) | | | | |
| 8. |  | Explain the following :   1. Weather cock stability. 2. Aileron power. 3. Aileron reversal. | CO3 | 4  6  10 |
|  | | **Compulsory:** |  |  |
| 9. |  | Explain the following term  a) Autorotation and Spin.  b) Dutch roll and Sprial Instability. | CO3 | 10  10 |