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BAS-023

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2015

00196

BAS-023 : AIRCRAFT DESIGN / LAUNCH VEHICLE / ROCKET DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

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1. A light UAV is to be designed for carrying an instrument/equipment load of 15 kgs. Its maximum velocity is 75 kmph. A pusher type piston-prop weighing 4·5 kgs capable of delivering 14 IHP is readily available.

(a) Work out gross weight for an endurance of 4 hrs.

(b) Carry out weight breakdown analysis.

(c) Prepare preliminary design of the wing.

(d) Work out major dimensions.

(e) Prepare a 3-view drawing.

Be reasonable to assume data required with justification. *10*

2. (a) Make use of representative sketches/diagrams to compare the design features of (i) AN-32, (ii) Boeing 737.

Which of the above is superior to the other in its own way ? 5

(b) Compare the aerodynamic, structural and propulsion aspects of HAL built Avro-748 and NAL designed SARAS airplane. Make use of sketches/diagrams representing these two airplanes. 5

3. Explain the role of aircraft mock-up in the design and development of a new airplane. Illustrate with emphasis on structural arrangement, layout and systems deployment. 10

4. Explain with representative sketches/diagrams the aerodynamics, structures and propulsion of the supersonic commercial jetliner Concorde.

(a) Which technical/engineering factors were its strong points ? 5

(b) What forced Concorde to retire from service ? 5

5. What are the possible locations of Jet engines on an airplane (both civil and military) ? Illustrate each of these with sketches/diagrams of existing/past airplanes. Describe the merits of them. 10

6. Bring out your choice of the location of the wing of an airplane from the following :

(a) High wing

(b) Low wing

(c) Mid wing

Design for a commercial, long range Jetliner. Argue on the basis of aerodynamics, structures, propulsion and other considerations. Make use of sketches, diagrams and plots to support your choice. *10*

7. Design a preliminary 3-view layout for a light UAV for a V_{max} of 90 kmph, W_{gross} of 125 kg and weight of air-borne equipment is 35 kg. A pusher type piston engine of 22 IHP weighing 8·5 kg is readily available. Keep the C_D as 0·025. Select suitable airfoil section and wing geometry for unmanned airplane. Assume missing data and follow proper design procedure for this problem. *10*

8. (a) Differentiate between tricycle and tail wheel configurations. *5*

(b) What are the advantages of lower taper ratio ? Explain with a neat sketch. *5*

9. What is the effect of the following in the performance of an airfoil : *5×2=10*

(a) Thickness to chord ratio

(b) Maximum thickness

(c) Location of maximum thickness

(d) Leading edge radius

(e) Location of maximum camber