Faculty of Engineering and Technology			
Ramaiah University of Applied Sciences			
Department	Civil Engineering	**Programme**	Bachelor of Technology
Semester/Batch	1st/2017		
Course Code	ESC106A	**Course Title**	Construction Materials & Engineering Mechanics
Course Leader(s)	Dr. Valsa Ipe / Ms. Deepthi M. V. / Mr. Shrihari K. Naik / Ms. Nimmy Mariam Abraham/ Mr. Divakar L.		

Assignment - 02			
Reg. No.		**Name of Student**	

Sections		Marking Scheme	Marks		
			Max	**First Examiner**	**Moderator**
Part A					
	A.1.1	Reasons for the stability of balancing bird and the leaning tower of Pisa	03		
	A.1.2	Importance of centre of gravity with the help of other examples from civil engineering	03		
	A.1.3	Stance taken with justification and conclusions	04		
		Part-A Max Marks	**10**		
Part B.1					
	B.1.1	Free body diagram	02		
	B.1.2	Determination of frictional force on the baggage for given horizontal load	02		
	B.1.3	Calculation of minimum load to be applied on the baggage to prevent it from sliding down	03		
	B.1.4	Calculation of the force required to cause the baggage move up the ramp	03		
		B.1 Max Marks	**10**		
Part B.2					
	B.2.1	Free body diagram	02		
	B.2.2	Calculation of support reactions	02		
	B.2.3	Calculation of member forces	06		
		B.2 Max Marks	**10**		
Part B.3					
	B.3.1	Assumption of suitable dimensions	02		
	B.3.2	Calculation of centre of gravity	08		
		B.3 Max Marks	**10**		
Part B.4					
	B.4.1	Calculation of moment of inertia about the centroidal axes	10		
		B.4 Max Marks	**10**		
		Total Assignment Marks	**50**		

Course Marks Tabulation				
Component-1 (B) Assignment	**First Examiner**	**Remarks**	**Moderator**	**Remarks**
A				
B.1				
B.2				
B.3				
B.4				
Marks (Max 50)				
Marks (out of 25)				
Signature of First Examiner			**Signature of Moderator**	

Please note:

1. Documental evidence for all the components/parts of the assessment such as the reports, photographs, laboratory exam / tool tests are required to be attached to the assignment report in a proper order.
2. The First Examiner is required to mark the comments in RED ink and the Second Examiner's comments should be in GREEN ink.
3. The marks for all the questions of the assignment have to be written only in the **Component – CET B: Assignment** table.
4. If the variation between the marks awarded by the first examiner and the second examiner lies within +/- 3 marks, then the marks allotted by the first examiner is considered to be final. If the variation is more than +/- 3 marks then both the examiners should resolve the issue in consultation with the Chairman BoE.

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Assignment

Term - 2

Instructions to students:

1. The assignment consists of **5** questions: Part A – **1** Question, Part B- **4** Questions.
2. Maximum marks is **50**.
3. The assignment has to be neatly word processed as per the prescribed format.
4. The maximum number of pages should be restricted to 20.
5. Restrict your report for Part-A to 3 pages only.
6. Restrict your report for Part-B to a maximum of 17 pages.
7. The printed assignment must be submitted to the course leader.
8. **Submission Date: 20 November 2017**
9. **Submission after the due date is not permitted.**
10. **IMPORTANT**: It is essential that all the sources used in preparation of the assignment must be suitably referenced in the text.
11. Marks will be awarded only to the sections and subsections clearly indicated as per the problem statement/exercise/question

Preamble:

This course deals with fundamentals of Civil Engineering materials and laws of Engineering Mechanics for statics/equilibrium of rigid bodies. Students will be taught the significance of Civil Engineering in infrastructure and exposed to construction materials. They will be trained on application of engineering mechanics to solve practical problems pertaining to statics/equilibrium of rigid bodies. In addition, effects of friction, energy methods for analysing static and dynamic analysis of rigid bodies will be dealt.

Part A **(10 marks)**

The centre of gravity of any body is the point at which its weight is perfectly balanced. The balancing bird shown in Figure 1 is a toy that has its centre of gravity located at the tip of the beak. It might seem strange that the bird is perfectly balanced at the beak location. The Leaning tower of Pisa is an example from civil engineering, which has not toppled even though it keeps leaning.

In this context, debate on the topic:

'**Location of centre of gravity is the only factor that governs the stability of any structure**'



Figure 1

Your debate should address the following:

A.1.1 Reasons for the stability of balancing bird and the leaning tower of Pisa

A.1.2 Importance of centre of gravity with the help of other examples from civil engineering

A.1.3 Stance taken with justification and conclusions

Part B **(40 marks)**

B.1 **(10 marks)**

The baggage having mass m is sliding on a ramp as shown in Figure 2. The ramp is inclined at 35^{o} to horizontal and has a coefficient of friction 0.25. If a person is applying a horizontal load of 8000 N to prevent the baggage from sliding down, determine the magnitude of frictional force on the baggage. Find the minimum load to be applied by the person on the baggage to prevent it from sliding down. Also, calculate the force required to cause the baggage move up the ramp.

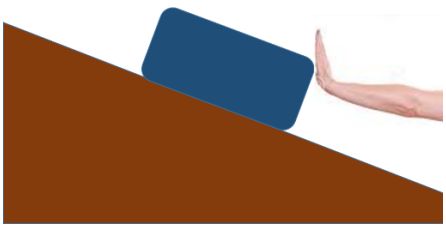

Figure 2

Your answer should include the following:

B.1.1 Free body diagram

B.1.2 Determination of frictional force on the baggage for given horizontal load

B.1.3 Calculation of minimum load to be applied on the baggage to prevent it from sliding down

B.1.4 Calculation of the force required to cause the baggage move up the ramp

Note: *Take* $m = 500 +$ *last 2 digits of your register number*.

B.2 **(10 marks)**

A truss bridge is as shown in Figure 3 with people standing at different points. If weights of two people are acting at point C and weights of 5 people are acting at point D, calculate the member forces. Assume hinged support at one end and roller support at the other end. Also, take each person's weight as 50 kg.

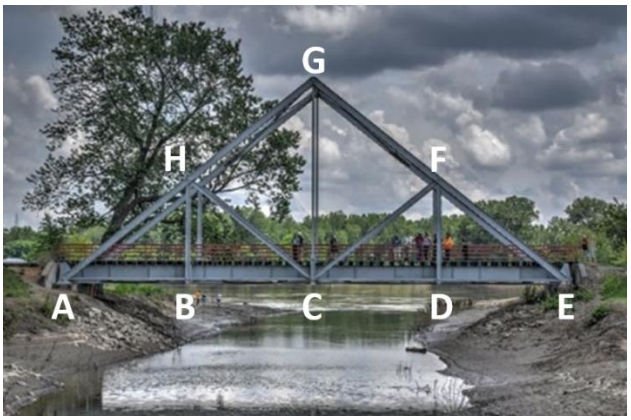

Figure 3

Your answer should include the following:

B.2.1 Free body diagram

B.2.2 Calculation of support reactions

B.2.3 Calculation of member forces

Note: *Take span of the bridge as 10 + x/15 m, where x is the last 2 digits of your register number and height as 6 m*.

B.3 **(10 marks)**

The centre of gravity of the human body is a hypothetical point around which the force of gravity appears to act. It is point at which the combined weight of the body appears to be concentrated. The direction of the force of gravity through the body is downward, towards the centre of the earth and through the centre of gravity. This line of gravity is important to understand and visualize when determining a person's ability to successfully maintain balance.

In the above context, determine the centre of gravity of human body. Human body given in Figure 4a may be represented with simple geometrical shapes as shown in Figure 4b.

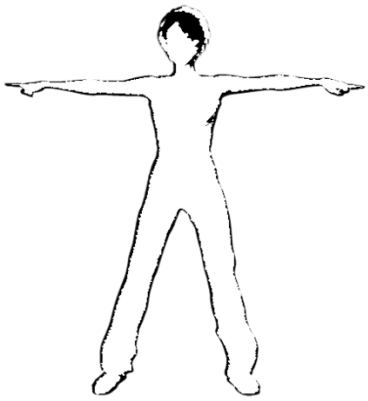

Figure 4a

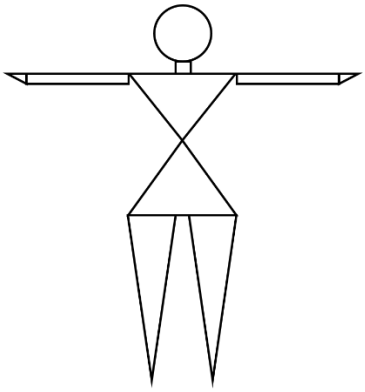

Figure 4b

Your answer should include the following:

B.3.1 Assumption of suitable dimensions

B.3.2 Calculation of centre of gravity

Note: Assume dimensions in consultation with course leader.

B.4 **(10 marks)**

Calculate the moment of inertia about the centroidal axes for the representation of human body given in question B3.

Your answer should include the following:

B.4.1 Calculation of moment of inertia about the centroidal axes