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Program: B.Sc. Engg. (IPE)
Semester: 5th Sem.

Date: 06 October 2023
Time: 10:30 am – 12:00 pm (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course No.: IPE 4513
Course Title: CAD/CAM/CAE

Winter Semester, A. Y. 2022-2023
Time: 1 Hours 30 Min(s)
Full Marks: 75

There are 3 (Three) questions. Answer all the questions.
Marks of each question and corresponding CO and PO are written in the brackets.
Do not write on this question paper.

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1. a) Draw a flow diagram of design processes involved in a product cycle and describe its steps. **[15] (CO1) (PO1)**

   b) Classify and describe different types of orthographic projections with necessary illustration. **[10] (CO1) (PO1)**

2. a) There are two coordinate systems $X_1Y_1Z_1$ and $X_2Y_2Z_2$, where Z_2 is opposite of Y_1, X_2 is parallel with Z_1, and Y_2 is opposite of X_1. The origin O_2 when measured in $X_1Y_1Z_1$ is (7, 5, 0). The $X_1Y_1Z_1$ coordinates of point P is (3, 0, 2). **[15] (CO1) (PO2)**

   (i) With respect to $X_1Y_1Z_1$, using the standard $Rot(x,\theta)$, $Rot(y,\theta)$, $Rot(z,\theta)$ and $Trans(a,b,c)$ to derive the transformation T^* that will transform the rigid body of $X_2Y_2Z_2$ to coincide with $X_1Y_1Z_1$.

   (ii) Calculate $P^* = T^* \bullet [3\ 0\ 2\ 1]^T$.

   (iii) Is T^* the $T_{1\to 2}$ or $T_{2\to 1}$?

   b) How is the Oct-tree representation computed? Explain why the octree representation requires less memory space than the voxel repetition for the same resolution. **[10] (CO1) (PO2)**

3. a) For a non-periodical and uniform B-spline curve of order 3 defined by the control points P_0, P_1, P_2, and P_3. There are two independent curves comprising this B-spline, each defined on the parameter range $u\in[0,1]$ and $u\in[1,2]$ respectively. Expand the B-spline curve equation to get the equation of the second segment. **[20] (CO1) (PO3)**

   b) How do you measure the degree "smoothness" of a curve? What is the minimum acceptable curve for engineering design and why? **[5] (CO1) (PO2)**