Birla Institute of Technology & Science, Pilani
Second Semester 2022-2023
ME F318 Computer aided design – Comprehensive Exam

No. of Pages = 4
No. of Questions = 6

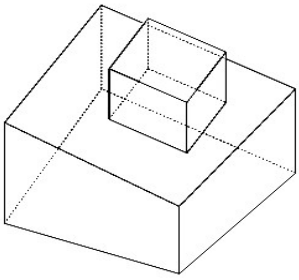
Weightage : 40% (As per Course Handout)
Marks : 80
Duration : 3.0 Hours
Date of Exam : 13/05/2023 (FN)

NAME

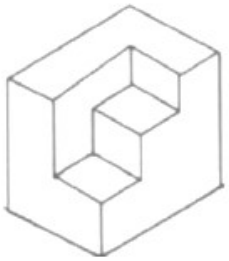
ID No.

Note to Students:
1. All parts of a question should be answered only in the space provided below each question.
2. **NO EXTRA SHEET WILL BE GIVEN.** Give your answers to the point.
3. Assumptions made, if any, should be stated clearly at the beginning of your answer.

1. Verify Euler-Poincaré relation topological validity for B-rep models below. **[12 Marks]**



F = …
E = …
V = …
L = …
B = …
G = …



F = …
E = …
V = …
L = …
B = …
G = …

2. Draw a neat sketch of a third order B-spline curve P(u) and a second order B-spline curve Q(u). Control points for P(u) are [0 0], [1 1], [3 1], and [4 0]. Control points for Q(u) are [0 4], [2 2], [2 0], and [0 -2]. Find the intersection point between P and Q. **[10 Marks]**

3. A triangle, in a 2-D (x and y) space, with vertices [3 1], [5 1], and [4 2] is reflected about a line $y = x$. Obtain final transformation matrix and transformed vertices. **[15 Marks]**

4. Parametric equation of helix with radius a and pitch b is [acos2πu asin2πu 2bπu], $0 \leq u \leq 1$. Write its explicit equation and bring out the advantages of its parametric form. **[8 Marks]**

5. Derive [*B*] of Hermite bicubic surface bounded by four lines shown in figure. **[10 Marks]**

6. Draw a neat sketch of a ruled surface R(u,v) formed by the two linearly blending curves P(u,0) and Q(u,1). P(u,0) is a third order B-spline curve defined by control points [0 0], [1 1], [3 1], and [4 0]. Q(u,1) is also a third order B-spline curve defined by control points [0 5], [1 6], [3 6], and [4 5]. Compute the midpoint of the surface also. **[25 Marks]**