SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur– 603203

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

VI SEMESTER

ME8691 COMPUTER AIDED DESIGN AND MANUFACTURING

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SUBJECT CODE / NAME : ME8691 COMPUTER AIDED DESIGN AND MANUFACTURING

SEM/YEAR : VI SEM / III YEAR

UNIT I - INTRODUCTION

Product cycle - Design process - sequential and concurrent engineering - Computer aided design – CAD system architecture - Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance.

PART A (2 Marks)

1	Define Product cycle.	BT1	Remembering
2	List out the various stages in the life cycle of a product.	BT1	Remembering
3	Differentiate preliminary design and detailed design.	BT1	Remembering
4	What is design process ? Mention the steps involved in shigley's Model for the design process.	BT2	Understanding
5	What do you mean by synthesis of design?	BT2	Understanding
6	What are the benefits of concurrent engineering?	BT2	Understanding
7	Write short notes on sequential engineering.	BT1	Remembering
8	Mention any four applications of computer aided design in mechanical engineering.	BT1	Remembering
9	Define computer graphics and write any two computer graphics applications.	BT1	Remembering
10	List the fundamental reasons for implementing a CAD system.	BT1	Remembering
11	What is Rendering?	BT1	Remembering
12	What is homogeneous coordinates?	BT1	Remembering
13	What is meant by viewport and windowing.	BT4	Analyzing
14	List and differentiate the types of 2D geometric transformations.	BT3	Applying
15	Rewrite about concatenation transformation.	BT4	Analyzing
16	What is the difference between CAD/CAM and CIM?	BT1	Remembering

17	What are types the production systems?	BT4	Analyzing
18	What are manufacturing metrics?	BT3	Applying
19	List out the commonly used production performance measures.	BT1	Remembering
20	Differentiate Manufacturing lead time and Work in process.	BT5	Evaluating

PART B (13 Marks)				
1	(i) With a block diagram ,explain the different phase of design and manufacturing process.	(7)	BT6	Creating
	(ii) What is meant by concurrent engineering? Describe the various schemes for concurrent engineering.	(6)	BT2	Understanding
2	List down the 2D transformation matrix for the following transformation processes. (i) Translation (ii) Scaling (iii) Rotation (iv) Shearing	(13)	BT1	Remembering
3	Describe homogeneous coordinate transformation system and matrix.	(13)	BT4	Analyzing
4	(i) Deduce windowing and viewing transformation matrix parametrically.	(7)	BT3	Analyzing
	(ii) What do you mean by composite transformation? How is it useful?	(6)	BT2	Understanding
5	(i) Discuss with suitable example, the various activities involved in generic product development process.	(7)	BT2	Understanding
	(ii)Draw and explain the CAD system architecture.	(6)	BT5	Evaluating
6	(i) Describe the role of computer in CAD? Draw flow diagram of CAD,	(7)	BT4	Analyzing
	(ii)Write their benefits and engineering applications of CAD.	(6)	BT2	Understanding
7	(i) Compare sequential and simultaneous engineering.	(7)	BT2	Understanding
	(ii) Explain the techniques involved in line drawing algorithm.	(6)	BT5	Understanding
8	Explain various two dimensional display control facilities in computer graphics.	(13)	BT4	Analyzing
9	Find the transformation matrix to transform the given matrix ABCD to three fourth of its size with centre still remaining at the same position. The coordinates of the rectangle are A(2,3),B(6,3),C(6,6),D(2,6) and its centre at (4,4.5). Also find the resultant coordinates of the given rectangle.	(13)	BT2	Understanding

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10	Write short note on the following items. (i) Line Drawing (ii) Digital Differential Analyzer Algorithm (iii) Bresenham's Line Algorithm.	(13)	BT3	Applying
11	Write short note on the following items. (i) Clipping (ii) Normalized Transformation (iii) Workstation Transformation.	(13)	BT6	Creating
12	(i) Explain CAD/CAM interface. (ii) Classify the production system. compare and contrast the characteristics of each of them.	(7) (6)	BT6 BT2	Creating Understanding
13	What are manufacturing metrics and explain commonly used production performance measures.	(13)	BT2	Understanding
14	List the various manufacturing planning and manufacturing control applications of CAM.	(13)	BT6	Creating

PART C (15 Marks)				
1	Analyze the use of clipping algorithm in the design .Explain one of the line clipping algorithm in details.	(15)	BT3	Applying
2	A triangle has coordinates with A(5,2),B(3,5) and C (7,5). (i) First rotate the triangle by 30^0 about the origin and then translate the triangle 2 units in X direction and 2 units in Y direction. (ii) Then translate the triangle 2 units in X direction and 2 units in Y direction and then rotate by 30^0 about the origin. Obtain the resultant coordinates for both cases and write your inferences.	(15)	BT4	Analyzing
3	What are the differences between the sequential approach to the product development process and the concurrent engineering approach? Why should the latter be adopted?	(15)	BT4	Analyzing
4	The average part produced in a batch manufacturing plant must be processed sequentially through six machines on average .Twenty new batches of parts are launched each week. Average operations time = 6 min,average set up time =5 hours, average batch size =36 parts and average non-operation time per batch = 10 hrs/machine. There are 18 machines in the plant working in parallel. Each of the machine can be set up for any type of job processed in the plant. The plant operates an average of 70 production hours per week. scrap rate is negligible. Determine manufacturing lead time for an average part, plant capacity and plant utilization.	(15)	BT6	Creating

UNIT II   GEOMETRIC MODELING

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.

	PART A (2 Marks)		
1	Define curve and free form curve.	BT1	Remembering
2	Write the equation of a circle in parametric form.	BT2	Understanding
3	List out the various Bezier curves based on control points.	BT2	Understanding
4	Write down the difference between Hermite curve and Bezier curve.	BT4	Analyzing
5	Mention any four characteristics of Bezier curves.	BT2	Understanding
6	List the types of parametric Bi-cubic Surface used in CAD.	BT4	Analyzing
7	State the limitations of B - Spline curve.	BT1	Remembering
8	Discuss the various types of surfaces.	BT1	Remembering
9	Illustrate the common surface entities used in a surface modeling.	BT3	Applying
10	Discuss how coon's surfaces are generated.	BT3	Applying
11	Distinguish between analytical curve and synthetic curve.	BT2	Understanding
12	Show the applications of surface modeling.	BT1	Remembering
13	Mention any two advantages and disadvantages of surface modeling.	BT2	Understanding
14	Differentiate between interpolated curves and approximated curves.	BT4	Analyzing
15	What is the use of surface patch?	BT1	Remembering
16	Differentiate the advantages and disadvantages of Bezier surface.	BT2	Understanding
17	Define geometrical modeling.	BT4	Analyzing
18	Mention the advantages and disadvantages of CSG.	BT2	Understanding
19	List the main advantages and drawback of wireframe modeling.	BT1	Remembering
20	Why B-rep modelling approaches are widely followed than CSG approach?	BT3	Applying

	PART B (13 Marks)			
1	(i) Write short notes on parametric representation of synthetic surfaces.	(7)	BT1	Remembering
	(ii) Write short notes on order of continuity.	(6)	BT1	Remembering
2	(i) Describe the representation of curves.	(7)	BT2	Understanding
	(ii) Find the shape of cubic spline curve if the result is (a) $P_0 = P_1$ and $P'_1 = P_0$ (b) $P_0 = P_1$ and $P_1' = - P_0'$.	(6)	BT3	Applying

3	Derive the transformation matrix for a Hermite curve.	(13)	BT2	Understanding
4	Elaborate about the Bezier curves with neat sketches and also explain how cubic Bezier curves can be modified.	(13)	BT1	Remembering
5	(i) What is B-Spline curve? Also explain it.	(7)	BT4	Analyzing
	(ii) Discuss the matrix formulation in cubic B-Spline curves.	(6)	BT2	Understanding
6	What is surface modelling? Discuss the various types of it and state the applications of surface modeling.	(13)	BT2	Understanding
7	(i) Write short notes on Surface Patch.	(7)	BT2	Understanding
	(ii) Discuss about coons surface.	(6)	BT4	Analyzing
8	(i) Write short notes on Bicubic surface patches.	(7)	BT3	Applying
	(ii) Elaborately discuss about rational curves.	(6)	BT2	Understanding
9	Briefly discuss about the Bezier surface and composite surface.	(13)	BT1	Remembering
10	Explain surface modeling and discuss the various types of it, Give the advantages, disadvantages and applications of surface modeling.	(13)	BT4	Analyzing
11	Explain constructive solid geometry technique. What is the role of primitive and Boolean operations in CSG? Explain with suitable examples.	(13)	BT4	Analyzing
12	What do you understand by Boundary representation (B-rep) technique of solid modeling? Explain the data structure of B-rep solid Model.	(13)	BT5	Evaluating
13	How does solid modeling differ from surface modeling? With neat sketch discuss briefly about B-rep type of solid modeling techniques.	(13)	BT3	Applying
14	Explain with sketch and construction tree involved in Boolean operation?	(13)	BT6	Creating

PART C (15 Marks)				
1	Describe the characteristics of Bezier curve with the control points, the order of continuity and What do you understand by blending function.	(15)	BT4	Analyzing
2	Distinguish between geometry and topology used in design of objects, Explain the primitive approach and the features approach, discuss various solid entities in solid models.	(15)	BT5	Evaluating
3	Take two solid objects of your choices and with the help of neat diagrams, explain various Boolean operations.	(15)	BT5	Evaluating
4	(i) Write short notes on characteristics of the B-Spline curves.	(9)	BT3	Applying
	(ii) Name the controlling points for generating curves.	(6)	BT2	Understanding

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UNIT III CAD STANDARDS

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALSetc. - Communication standards.

PART A (2 Marks)

1	What are CAD standards and its need?	BT1	Remembering
2	List out the international organizations involved to develop the graphics standards.	BT1	Remembering
3	What is GKS cell array?	BT2	Understanding
4	What is the objective of GKS-3D standard?	BT4	Analyzing
5	Name the various interface standards at different levels.	BT2	Understanding
6	What is the need of data exchange?	BT3	Applying
7	Give the types of graphics standard.	BT2	Understanding
8	Write any four data exchange formats.	BT1	Remembering
9	Classify GKS and sketch the layer model of GKS.	BT2	Understanding
10	Compare PHIGS and IGES.	BT1	Remembering
11	Illustrate the various features of PHIGS.	BT1	Remembering
12	Write short notes on Open Graphics library.	BT2	Understanding
13	Show the limitations of IGES and DXF.	BT4	Analyzing
14	Point out the features of NAPLPS.	BT1	Remembering
15	Tabulate the basic sections in DXE File format.	BT5	Evaluating
16	Obtain a sketch for three layered architecture for product data exchange.	BT3	Applying
17	Assess the various file section in IGES.	BT1	Remembering
18	Draw the three layer architecture of STEP.	BT1	Remembering
19	Create the flow diagram to communicate between two CAD systems using IGES.	BT3	Applying
20	Discuss the advantage of open graphics library.	BT1	Remembering

PART B (13 Marks)

1	(i)Define Graphics Keneral System. Explain briefly with suitable examples.	(7)	BT6	Creating
	(ii)Examine IGES data exchange format.	(6)	BT5	Evaluating
2	Describe the data exchange standard and development in data exchange format.	(13)	BT6	Creating

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3	(i) Write short notes on data base management.	(7)	BT6	Creating
	(ii) Identify the thrust involved in developing CAD standards.	(6)	BT4	Analyzing
4	(i)Describe PHIGS.	(7)	BT4	Analyzing
	(ii)Show how data is exchanged between two cad systems.	(6)	BT3	Applying
5	(i) Summarize the standards for exchanging images.	(7)	BT5	Evaluating
	(ii) Discuss about open graphics library.	(6)	BT4	Analyzing
6	(i) Describe (1) Local area network (2) Wide area network.	(7)	BT5	Evaluating
	(ii)Describe Standard for the Exchange of product model Data (STEP) in detail.	(6)	BT2	Understanding
7	(i) Describe the types of Graphics Standards.	(7)	BT3	Applying
	(ii)Discuss the two basic items of GKS such as primitives and attributes.	(6)	BT3	Applying
8	(i).Examine the features of open GL.	(7)	BT1	Remembering
	(ii).Illustrate (1) Direct CAD system Export (2) Direct Translation software (3) Neutral data exchange format.	(6)	BT2	Understanding
9	Classify the Neutral file formats and Explain in detail.	(13)	BT6	Creating
10	Analyze Continuous acquisition and life cycle support and elaborate their types.	(13)	BT1	Remembering
11	Explain Product Data Exchange standard and draw the three layer architecture of PDES.	(13)	BT6	Creating
12	Infer the different levels of graphics standard communication and elaborate each of them.	(13)	BT2	Understanding
13	(i) Explain drawing exchange format (DXF).	(7)	BT1	Remembering
	(ii) Compare IGES and STEP.	(6)	BT4	Analyzing
14	Elaborate (i) HTML (ii) VRML (iii) CGM (iv) BITMAPS (v) Computer Aided Design Interface.	(13)	BT4	Analyzing

PART C (15 Marks)				
1	Explain the following polyhedral object using b-rep elements and verify the Euler equation for the same (i) simple polyhedra. (ii) Polyhedral object a face may have loops. (iii) Objects with holes that do not go through the entire object. (iv) Objects have holes that go through entire objects.	(15)	BT6	Creating
2	Evaluate the various testing methods of IGES processors.	(15)	BT6	Creating
3	Formulate different STEP architecture with neat sketch and justify the suitable one for graphics standard.	(15)	BT6	Creating
4	List and explain the basic requirements and principles of communication protocol.	(15)	BT3	Applying

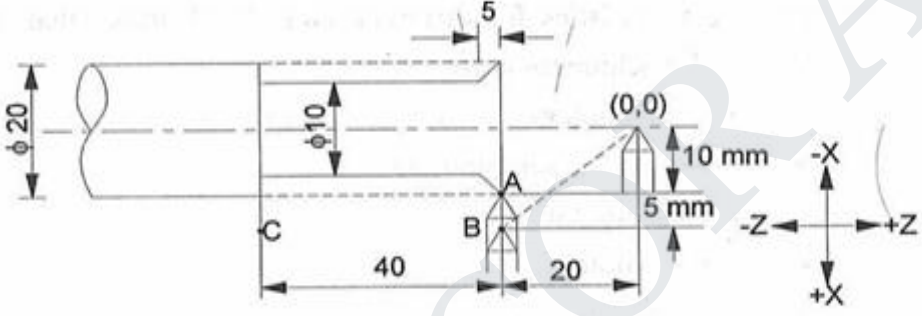### UNIT- IV FUNDAMENTAL OF CNC AND PART PROGRAMING

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools Principle of operation CNC- Construction features including structure- Drives and CNC controllers2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

	PART A (2 Marks)		
1	Mention the points to be considered while designing of CNC tooling.	BT2	Understanding
2	List the features of NC part programming.	BT1	Remembering
3	State the advantages of integrating computer with NC machine tools.	BT2	Understanding
4	Mention the various problems with conventional NC machines.	BT6	Creating
5	Name the methods of specifying the zero point.	BT1	Remembering
6	Enumerate about linear bearings.	BT3	Applying
7	State the advantages of incremental positioning.	BT2	Understanding
8	List the elements of NC system.	BT1	Remembering
9	Name the various elements of CNC machines.	BT4	Analyzing
10	Distinguish between open and closed loop system.	BT2	Understanding
11	Draw the simple configuration of CNC.	BT3	Applying
12	Classify CNC systems.	BT2	Understanding
13	Distinguish NC and CNC systems.	BT4	Analyzing
14	Why re-circulating screws are used in CNC machines?	BT4	Analyzing
15	Differentiate machine reference and tool reference point.	BT2	Understanding
16	Give the general form of a program line.	BT1	Remembering
17	Point out the importance of tool magazine in CNC machine.	BT1	Remembering
18	Define preset tooling.	BT2	Understanding
19	Write a note on canned cycle.	BT4	Analyzing
20	Define Subroutine.	BT1	Remembering

	PART B (13 Marks)			
1	(i) Describe the design considerations of NC machines, which are essential for proper functioning.	(9)	BT4	Analyzing
	(ii) Discuss about slide ways used in CNC machine tools, for various applications.	(4)	BT3	Applying

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2	(i) Describe 2D and 3D machining in CNC machines with a suitable example.	(7)	BT6	Creating
	(ii) With a neat sketch, explain the working of ATC.	(6)	BT5	Evaluating
3	(i) Describe about spindles used in CNC machine tools.	(7)	BT4	Analyzing
	(ii) Describe the functions of feed drives. Also state the requirement of the drives in CNC machine tools.	(6)	BT4	Analyzing
4	Explain the following in CNC machining.		BT3	Applying
	(i) Linear interpolation	(5)		
	(ii) Circular interpolation	(5)		
	(iii) Cubic interpolation	(3)		
5	Write the part program for the part shown below.	(13)	BT6	Creating
6	Explain the main difference between point to point and continuous path of numerically controlled machine tools, with a specific example.	(13)	BT4	Analyzing
7	Explain the various elements of NC machine with closed loop control system and its implications on NC control.	(13)	BT3	Applying
8	Discuss the advantages of computer numerical control system. What is the difference between positioning machines and contouring machines? State a few typical applications where the use of numerical control would be justified.	(13)	BT2	Understanding
9	(i) Describe the spindle heads used in CNC machines and list out their merits.	(7)	BT4	Analyzing
	(ii) List the difference between manual and computer assisted part programming.	(6)	BT4	Analyzing
10	Write the part program for drilling holes in the part shown below. the plate thickness is 20mm.	(13)	BT1	Remembering

11	Describe in detail about subroutines and give the programming structure in subroutine.	(13)	BT3	Applying
12	Explain the following, (i) Loop (ii) Startup block (iii) CAM package	(5) (5) (3)	BT6	Creating
13	Describe in detail about macros and give the programming structure in macros.	(13)	BT2	Understanding
14	Describe in detail about CATIA, CAM work and Bob CAD CAM. Also mention the merits and demerits of each package.	(13)	BT6	Creating

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PART C (15 Marks)			
1	 Justify the absolute coordinates and incremental coordinates for the above fig and point out the best one.	(15)	BT6	Creating
2	 Analyze the above fig and write a CNC program that takes minimum time for production.	(15)	BT5	Evaluating

3	Evaluate the following functions in CNC machining.
	  (i) M codes and G codes (5)
	  (ii) Program sheet (5)
	  (iii) Canned cycle (5)
		(15)	BT5	Evaluating

4	Compare the hydraulic and pneumatic drives in CNC machining and evaluate the outcome.	(15)	BT5	Evaluating

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UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS)

Group Technology (GT), Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control–Quantitative analysis in FMS

	PART A (2 Marks)		
1	Define group technology.	BT3	Applying
2	List the roles of group technology in CAD/CAM integration.	BT2	Understanding
3	Compare monocode with polycode.	BT2	Understanding
4	Define part family.	BT5	Evaluating
5	List the coding systems that are successfully implemented in industries	BT1	Remembering
6	What are the advantages of group Technology?	BT3	Applying
7	Define composite part.	BT4	Analyzing
8	Distinguish the steps involved in production flow analysis.	BT4	Analyzing
9	Mention the three basic code structure used in GT application.	BT1	Remembering
10	Define cellular manufacturing.	BT3	Applying
11	List the components of FMS.	BT2	Understanding
12	Define flexible manufacturing system.	BT1	Remembering
13	Identify any four functions of the material handling systems in a FMS.	BT3	Applying
14	Name the different types of layout configuration prevalent in FMSs.	BT4	Analyzing
15	Differentiate between primary and secondary material handling systems.	BT1	Remembering
16	What is meant by AGV and write its components?	BT2	Understanding
17	Summarize some of the functions of a FMS computer system.	BT4	Analyzing
18	Classify FMS based on number of machines.	BT2	Understanding
19	List the FMS layout configurations.	BT1	Remembering
20	Mention the different types of data files required for a FMS.	BT1	Remembering

	PART B (13 Marks)			
1	(a) List the various benefits of implementing a GT in a firm. Also bring out the advantages and limitation of using GT.	(7)	BT1	Remembering
	(b) Discuss the ways to identify the part families.	(6)	BT2	Understanding
2	Describe about group technology. Also explain why GT is important in achieving CAD and CAM integration.	(13)	BT3	Applying
			BT2	Understanding

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3	(a) State the criteria used for cell design.	(7)	BT4	Analyzing
	(b) Enumerate on the parts classification and coding system and its features.	(6)	BT2	Understanding
4	Explain the various machine cells and layouts in used industries.	(13)	BT4	Analyzing
5	Summarize how group technology is used in designing manufacturing cells.	(13)	BT3	Applying
6	Write short notes on		BT4	Analyzing
	a) Opitz coding system	(4)		
	b) MICLASS	(3)		
	c) DCLASS	(3)		
	d) PFA	(3)		
7	Discuss about (i) Composite part concept (ii) Key machine concept	(13)	BT2	Understanding
8	a) List the major components of an FMS. Explain them in brief.	(7)	BT1	Remembering
	(b) Describe the various workstations of FMS.	(6)	BT5	Evaluating
9	(a) Discuss the various aspects of FMS layout configurations	(7)	BT1	Remembering
	(b) Interpret the various functions that are performed by the FMS computer control system.	(6)	BT3	Applying
10	Examine flexible manufacturing system. In what ways, FMS differs from other manufacturing systems.	(13)	BT2	Understanding
11	(a) List the functions of the material handling system in a FMS.	(7)	BT1	Remembering
	(b) Explain the applications, advantages and disadvantages of a FMS.	(6)	BT1	Remembering
12	Summarize with suitable sketches, explain the various FMS layout configurations prevalent today.	(13)	BT2	Understanding
13	(a) Show distinguishing facts between FMS and FMC.	(7)	BT3	Applying
	(b) Distinguishing facts between Dedicated FMS and Random-order FMS.	(6)	BT1	Remembering
14	(a) Discuss the important of In-process monitoring of work piece quality in FMS.	(7)	BT2	Understanding
	(b) Express how is tool life monitored in FMS.	(6)	BT5	Evaluating

PART C (15 Marks)				
1	Evaluate the Vehicle Guided Technology and guidance method in detail with their advantages and disadvantages.	(15)	BT5	Evaluating
2	Write a case study on automated storage and retreival system (AS/RS) used in industries.	(15)	BT4	Analyzing
3	Enumerate on the vehicle management system & vehicle safety deployed in the material handling system of the FMS.	(15)	BT6	Creating
4	Explain the main FMS operational issues to be considered and What types of quantitative analysis may be used with regard to FMS.	(15)	BT3	Applying

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