SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur– 603203.

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTIONBANK

VII SEMESTER

PME605 NEW PRODUCT DESIGN AND DEVELOPMENT

Regulation–2023

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UNIT I FUNDAMENTALS OF NPD

Introduction – Reading of Drawing – Grid reading, Revisions, ECN (Engg. Change Note), Component material grade, Specifications, customer specific requirements – Basics of monitoring of NPD applying Gantt chart, Critical path analysis – Fundamentals of BOM (Bill of Materials), Engg. BOM & Manufacturing BOM. Basics of MIS software and their application in industries like SAP, MS Dynamics, Oracle ERP Cloud – QFD.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define New Product Development (NPD).	BT-1	Remember
2.	List the major stages involved in the New Product Development process.	BT- 1	Remember
3.	What is meant by engineering drawing?	BT- 1	Remember
4.	Define grid reading in an engineering drawing.	BT- 1	Remember
5.	What is the purpose of drawing revisions?	BT-2	Understand
6.	What is an Engineering Change Note (ECN)?	BT- 1	Remember
7.	State the importance of an Engineering Change Note (ECN).	BT-2	Understand
8.	What is meant by component material grade?	BT- 1	Remember
9.	Why are material specifications important in product development?	BT-2	Understand
10.	What are customer-specific requirements?	BT- 1	Remember
11.	Define a Gantt chart.	BT- 1	Remember
12.	Mention two advantages of using a Gantt chart in project monitoring.	BT-2	Understand
13.	What is Critical Path Analysis (CPA)?	BT- 1	Remember
14.	What is the significance of the critical path in project scheduling?	BT-2	Understand
15.	Define Bill of Materials (BOM).	BT- 1	Remember
16.	Differentiate between Engineering BOM (EBOM) and Manufacturing BOM (MBOM).	BT-2	Understand
17.	What information is typically included in a Bill of Materials?	BT-1	Remember

18.	Name any four Management Information Systems (MIS) software used in industries.	BT-1	Remember
19.	What is the role of SAP in New Product Development?	BT-1	Remember
20.	Mention the applications of ERP software in manufacturing industries.	BT-1	Remember
21.	Define the term QFD.	BT-1	Remember
22.	What is the primary objective of Quality Function Deployment (QFD)?	BT-1	Remember
23.	How does QFD help in improving customer satisfaction?	BT-2	Understand
24.	Why is document control important during product development?	BT-2	Understand
25.	Write the relationship between engineering drawings and BOM in New Product Development.	BT-1	Remember

PART-B (16 Mark)

Q.No	Questions	Marks	BT Level	Competence
1	Explain the stages involved in New Product Development.	16	BT-3	Apply
2	Discuss the importance of engineering drawings in product development.	16	BT-3	Apply
3	Illustrate the procedure for preparing the Engineering BOM and the Manufacturing BOM.	16	BT-3	Apply
4	Explain the application of Gantt charts in monitoring NPD projects.	16	BT-3	Apply
5	Develop a Critical Path Analysis for a new product development project.	16	BT-4	Analyze
6	Compare the Engineering BOM and Manufacturing BOM.	16	BT-3	Apply
7	Explain the role of SAP, MS Dynamics, and Oracle ERP Cloud in NPD.	16	BT-3	Apply
8	Discuss the importance of Engineering Change Notes (ECN) in product development.	16	BT-3	Apply
9	Explain the Quality Function Deployment (QFD) process with suitable illustrations.	16	BT-3	Apply
10	Discuss customer-specific requirements during product development.	16	BT-3	Apply
11	Describe drawing revision control procedures.	16	BT-3	Apply
12	Explain grid reading and drawing interpretation with examples.	16	BT-3	Apply

13	Discuss material specifications and engineering documentation in NPD.	16	BT-3	Apply
14	Explain the importance of project scheduling in new product development.	16	BT-3	Apply
15	Develop a workflow for Engineering change management.	16	BT-4	Analyze
16	Explain the relationship between BOM preparation and manufacturing planning.	16	BT-3	Apply
17	Compare conventional project planning and Gantt chart-based planning.	16	BT-4	Analyze
18	Explain the complete documentation flow involved in the initial phase of NPD.	16	BT-3	Apply

UNIT II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS

Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	What is meant by material specification in product design?	BTL-1	Remembering
2.	Write the abbreviations ISO, DIN, JIS, ASTM, and EN.	BTL-1	Remembering
3.	State the purpose of international material specification standards.	BTL-2	Understanding
4.	Differentiate between ISO and ASTM standards.	BTL-2	Understanding
5.	Why is material grade specified in engineering drawings?	BTL-2	Understanding
6.	Define metal casting.	BTL-1	Remembering
7.	List any four metal casting processes.	BTL-1	Remembering
8.	What is meant by metal forming? Give two examples.	BTL-2	Understanding
9.	Differentiate between metal casting and metal forming.	BTL-2	Understanding
10.	Define conventional machining.	BTL-1	Remembering
11.	Distinguish between conventional machining and CNC machining.	BTL-2	Understanding
12.	Compare 3-axis machining with 5-axis machining.	BTL-2	Understanding
13.	State any two advantages of 5-axis machining.	BTL-2	Understanding
14.	Define fabrication in manufacturing.	BTL-1	Remembering
15.	List any four commonly used welding processes.	BTL-1	Remembering
16.	What are the mechanical properties of engineering materials?	BTL-1	Understanding
17.	What are the physical properties of engineering materials?	BTL-1	Remembering
18.	What are the chemical properties of engineering materials?	BTL-1	Remembering
19.	Why is a material test report prepared in product development?	BTL-2	Understanding
20.	Define DFMEA and state its objective.	BTL-1	Remembering
21.	Differentiate between DFMEA and PFMEA.	BTL-2	Understanding

22.	What is Finite Element Analysis (FEA)?	BTL-1	Understanding
23.	State the purpose of the bend analysis in product design.	BTL-2	Understanding
24.	What is meant by hot distortion analysis?	BTL-1	Remembering
25.	What is fill and solidification analysis? State its significance in casting.	BTL-2	Understanding

	PART-B (16 Mark)			
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1	Explain the importance of material specification standards of ISO, DIN, JIS, ASTM, and EN in new product development with suitable examples.	16	BT-3	Apply
2	Explain the principle of Sand Casting with a neat sketch. Discuss its advantages, limitations, and applications.	16	BT-3	Apply
3	Explain the principles of Die Casting and Investment Casting with a neat sketch. Discuss its advantages, limitations, and applications.	16	BT-3	Apply
4	Explain the principle of the Rolling Process and the Extrusion Process with a neat sketch.	16	BT-3	Apply
5	Explain the principles of the Forging Process and Deep Drawing Process with a neat sketch.	16	BT-3	Apply
6	Explain the principles and applications of conventional machining, CNC machining, 3-axis, 4-axis, and 5-axis machining.	16	BT-3	Apply
7	Explain various fabrication processes and describe the commonly used welding processes with their applications.	16	BT-3	Apply
8	Explain the mechanical, physical, and chemical properties of engineering materials and discuss the methods used to evaluate them.	16	BT-3	Apply
9	Describe the preparation of a material test report and explain the significance of mechanical, physical, and chemical testing in quality assurance.	16	BT-3	Apply
10	Explain the fundamentals of DFMEA and discuss its role in product design.	16	BT-3	Apply
11	Describe the fundamentals of FEA and explain its applications in new product development.	16	BT-4	Analyze
12	Explain the principles and applications of Bend Analysis and Hot Distortion Analysis.	16	BT-3	Apply

13	Explain the principles and applications of Metal Flow Analysis and Fill & Solidification Analysis.	16	BT-3	Apply
14	Explain the fundamentals of Design Failure Mode and Effects Analysis (DFMEA) and discuss its role in product design.	16	BT-4	Analyze
15	Explain design guidelines for casting and welding in DFMA.	16	BT-3	Apply
16	Discuss the DFMA methodology used in product development. Explain the design guidelines for manufacturing and assembly,	16	BT-3	Apply
17	Explain the design guidelines for assembly in manufacturing.	16	BT-3	Apply
18	Explain the role of material specifications, manufacturing processes, quality testing, and simulation techniques in the successful development of a new product.	16	BT-3	Apply

UNIT III ESSENTIALS OF NPD

RFQ (Request of Quotation) Processing – Feasibility Studies & reporting – CFT (Cross Function Team) discussion on new product and reporting – Concept design, Machine selection for tool making, Machining – Manufacturing Process selection, Machining Planning, cutting tool selection – Various Inspection methods – Manual measuring, CMM – GOM (Geometric Optical Measuring), Lay out marking and Cut section analysis. Tool Design and Detail drawings preparation, release of details to machine shop and CAM programing. Tool assembly and shop floor trials. Initial sample submission with PPAP documents.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	What is the purpose of Request for Quotation (RFQ) in new product development?	BT-1	Remembering
2.	What are the major types of feasibility studies conducted before the development of a new product?	BT-1	Remembering
3.	What is the role of a Cross Functional Team (CFT) during new product development?	BT-1	Remembering
4.	What is concept generation in product design?	BT-1	Remembering
5.	State any four factors considered during concept selection.	BT-2	Understanding
6.	List any four criteria for selecting a machine tool.	BT-1	Remembering
7.	What is meant by manufacturing process selection?	BT-1	Remembering
8.	State any four factors affecting manufacturing process selection.	BT-2	Understanding
9.	Why is operation sequencing important in machining planning?	BT-2	Understanding
10.	What is routing in process planning?	BT-1	Remembering
11.	Differentiate between inspection and quality control.	BT-2	Understanding
12.	List the objectives of inspection.	BT-1	Remembering
13.	Name any four manual measuring instruments used for inspection.	BT-2	Understanding
14.	What is GOM (Geometric Optical Measuring)?	BT-1	Remembering
15.	Classify Coordinate Measuring Machine (CMM).	BT-2	Understanding
16.	What is meant by layout marking? State its purpose.	BT-1	Remembering
17.	Define cut section analysis.	BT-1	Remembering
18.	What is tool design? Why is it important in manufacturing?	BT-1	Remembering
19.	Summarize the purpose of preparing detailed drawings before tool	BT-2	Understanding

	manufacturing.		
20.	What is CAM programming? Mention its role in tool manufacturing.	BT-1	Remembering
21	List out the purpose of the tool assembly and shop floor trials.	BT-1	Remembering
22	What is PPAP? State the purpose of the initial sample submission.	BT-2	Understanding
23	Differentiate between contact inspection methods and non-contact inspection methods.	BT-2	Understanding
24	List any four documents included in a PPAP submission package.	BT-1	Remembering
25	What is the purpose of CAM programming in tool manufacturing?	BT-1	Remembering

	PART-B (16 Marks)			
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1	Explain the RFQ (Request for Quotation) processing procedure in new product development with a neat flow chart.	16	BT-4	Analyze
2	Discuss the information required and the significance of RFQ in customer order processing.	16	BT-3	Apply
3	Explain the role of the Cross-Functional Team (CFT) in new product development. Discuss the responsibilities of each department and illustrate the workflow with a neat diagram.	16	BT-3	Apply
4	Explain the concept design process using a clear flowchart and discuss concept generation, concept evaluation, and concept selection techniques used in product development.	16	BT-3	Apply
5	Explain the steps involved in machining process planning with a neat process flow chart. Discuss operation sequencing, setup planning, routing, and process documentation.	16	BT-3	Apply
6	Explain the criteria for cutting tool selection with suitable examples. Discuss the selection of cutting tool materials based on workpiece material, machining operation, cutting speed, feed, and tool life.	16	BT-3	Apply
7	Discuss the factors affecting manufacturing process selection for different engineering materials and product geometries with suitable examples.	16	BT-3	Apply

8	Explain the criteria for cutting tool selection with suitable examples. Discuss the selection of cutting tool materials based on workpiece material, machining operation, cutting speed, feed, and tool life.	16	BT-3	Apply
9	Describe the complete workflow from RFQ receipt to machining process planning for a new product using a neat flow chart.	16	BT-4	Analyze
10	Explain the various inspection methods used in new product development. Compare manual inspection, CMM inspection, and GOM inspection with suitable examples.	16	BT-4	Analyze
11	Explain the working principle of a Coordinate Measuring Machine (CMM) and Geometric Optical Measuring (GOM) with a neat sketch.	16	BT-4	Analyze
12	Describe the tool assembly procedure with a neat sketch. Discuss the checks carried out before tool commissioning and production.	16	BT-3	Apply
13	Explain the fundamentals of CAM programming with a neat flow chart. Discuss the steps involved in generating CNC programs from CAD	16	BT-3	Apply
14	Explain the procedure for preparing detail drawings for tool manufacturing. Discuss the standards, dimensions, tolerances, and annotations used in engineering drawings.	16	BT-3	Apply
15	Explain the procedure of layout marking and cut section analysis with neat sketches. Discuss their importance in tool development and quality inspection.	16	BT-3	Apply
16	Discuss the design considerations involved in tool design. Explain the steps involved in preparing detailed tool drawings for manufacturing.	16	BT-3	Apply
17	Explain the Initial Sample Submission Process (ISSP) and discuss the purpose, stages, and customer approval procedure in new product development.	16	BT-3	Apply
18	Explain the Production Part Approval Process (PPAP). Discuss the objectives, major PPAP documents, submission levels, and their importance in customer approval.	16	BT-3	Apply

UNIT IV CRITERIONS OF NPD

New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	What is meant by new product qualification?	BTL-1	Remembering
2.	Why is dimensional inspection important in new product qualification?	BTL-2	Understanding
3.	What are the mechanical properties evaluated during product qualification?	BTL-1	Understanding
4.	List any four physical properties of engineering materials.	BTL-1	Understanding
5.	What is internal soundness in a manufactured component?	BTL-1	Remembering
6.	What is the purpose of X-ray testing in product qualification?	BTL-2	Remembering
7.	Define radiographic testing (RT).	BTL-1	Remembering
8.	What is Ultrasonic Testing (UT)?	BTL-1	Remembering
9.	State any two advantages of Ultrasonic Testing.	BTL-2	Remembering
10.	Expand MPT and state its purpose.	BTL-1	Understanding
11.	Name any four Non-Destructive Testing (NDT) methods used in product qualification.	BTL-1	Remembering
12.	Differentiate between destructive testing and non-destructive testing.	BTL-2	Remembering
13.	Why is testing frequency agreed upon with the customer?	BTL-2	Remembering
14.	What is meant by testing frequency?	BTL-1	Understanding
15.	What is a market survey in new product development?	BTL-1	Understanding
16.	State any four objectives of a market survey.	BTL-1	Remembering
17.	Define risk analysis.	BTL-1	Remembering
18.	List any four risks considered during new product development.	BTL-2	Remembering
19.	What is sample validation?	BTL-1	Understanding
20.	Why are simulation results compared with actual sample results?	BTL-2	Remembering

21.	What is meant by "Lessons Learned" in new product development?	BTL-1	Remembering
22.	Define horizontal deployment.	BTL-1	Remembering
23.	State the benefits of horizontal deployment in product development.	BTL-2	Remembering
24.	What is the purpose of documenting lessons learned after product development?	BTL-2	Remembering
25.	Why is customer approval essential before product launch?	BTL-2	Remembering

PART-B (16 Marks)				
Q. No	**Questions**	**Marks**	**BT Level**	**Competence**
1	Explain the product qualification process for a new product. Discuss the methods used for dimensional inspection, verification of mechanical properties, and physical property evaluation and explain in detail.	16	BT-3	Apply
2	Explain the procedure for conducting a tensile test and discuss its importance in qualifying a new product.	16	BT-4	Analyze
3	Explain the procedure for conducting hardness and impact tests with neat sketches. Discuss their importance in qualifying a new product.	16		
4	Explain the methods used to evaluate the physical properties of engineering materials. Discuss their importance in material selection for new product development.	16	BT-3	Apply
5	Explain the principle, working, advantages, limitations, and applications of X-ray (Radiographic) Testing (RT) with a neat sketch.	16	BT-3	Apply
6	Explain the principle, working, advantages, limitations, and applications of Ultrasonic Testing (UT) with a neat sketch.	16	BT-4	Analyze
7	Explain the principle, working, advantages, limitations, and applications of Magnetic Particle Testing (MPT) with a neat sketch.	16	BT-3	Apply
8	Discuss the importance of customer agreement on testing frequencies in new product development. Explain the factors considered while preparing a testing and inspection plan.	16	BT-4	Analyze
9	Explain the procedure for conducting a market survey for a new product. Discuss the techniques used for competitor	16	BT-3	Apply

	analysis, customer requirement analysis, and product benchmarking.			
10	Explain the concept of risk analysis in new product development. Discuss the different types of risks, risk assessment methods, and mitigation strategies with suitable examples.	16	BT-3	Apply
11	Explain the procedure for validating initial samples using simulation results. Discuss the importance of correlation between simulation and experimental validation in product development.	16	BT-3	Apply
12	Explain the concepts of 'Lessons Learned' and 'Horizontal Deployment' in new product development. Discuss their role in continuous improvement and prevention of recurring design and manufacturing issues.	16	BT-3	Apply
13	Describe the complete qualification process of a new product from dimensional verification, material testing, non-destructive testing, customer approval, market survey, risk analysis, sample validation, and lessons learned using a neat flow chart.	16	BT-4	Analyze
14	Discuss the relevant ASTM/ISO standards followed for mechanical and physical property testing. Explain the importance of standardized testing procedures in ensuring product quality and customer acceptance	16	BT-4	Analyze
15	Explain the procedure for planning and executing a mechanical and physical property qualification program for a newly developed product. Discuss the sequence of tests and acceptance criteria.	16	BT-3	Apply
16	Explain the relationship between material selection, manufacturing process, and mechanical & physical properties in new product development. Illustrate your answer with suitable industrial examples.	16	BT-3	Apply
17	Explain the applications of Radiographic Testing (RT) in new product qualification and internal soundness evaluation.	16	BT-3	Apply
18	Describe the product qualification workflow involving material certification, mechanical testing, physical testing, acceptance criteria, documentation, and customer approval using a neat flow chart.	16	BT-4	Analyze

UNIT V REPORTING & FORWARD-THINKING OF NPD

Detailed study on PPAP with 18 elements reporting, APQP and its 5 Sections, APQP vs PPAP, Importance of SOP (Standard Operating Procedure) – Purpose & documents, deployment in shop floor. Prototyping & RPT - Concepts, Application and its advantages, 3D Printing – resin models, Sand cores for foundries; Reverse Engineering. Cloud points generation, converting cloud data to 3D model – Advantages & Limitations of RE, CE (Concurrent Engineering) – Basics, Application and its advantages in NPD (to reduce development lead time, time to Market, improve productivity and product cost.)

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define the term PPAP.	BT-1	Remembering
2.	What is the purpose of the Production Part Approval Process (PPAP)?	BT-1	Remembering
3.	List out the elements that are included in a PPAP submission package.	BT-1	Remembering
4.	What is meant by Part Submission Warrant (PSW) in PPAP?	BT-1	Remembering
5.	Define the term APQP.	BT-1	Remembering
6.	List the five phases of APQP.	BT-1	Remembering
7.	Write the objective of Advanced Product Quality Planning (APQP)	BT-1	Remembering
8.	Differentiate between APQP and PPAP in terms of their objectives.	BT-2	Understanding
9.	Define Standard Operating Procedure.	BT-1	Remembering
10.	State the importance of SOP in manufacturing industries.	BT-1	Remembering
11.	List out the documents included in a Standard Operating Procedure (SOP).	BT-1	Remembering
12.	What is meant by SOP deployment on the shop floor?	BT-1	Remembering
13.	Define prototyping.	BT-1	Understanding
14.	State any four advantages of Rapid Prototyping Technology (RPT).	BT-2	Understanding
15.	Define 3D printing and resin model in 3D printing.	BT-1	Remembering
16.	Why are sand cores produced using 3D printing in foundries?	BT-2	Understanding
17.	Define Reverse Engineering (RE).	BT-1	Remembering
18.	What is point cloud generation in reverse engineering?	BT-1	Remembering
19.	How is point cloud data converted into a 3D model?	BT-2	Understanding

20.	How does Reverse Engineering support product redesign and improvement?	BT-2	Understanding
21.	List any two limitations of Reverse Engineering.	BT-1	Remembering
22.	What is Concurrent Engineering (CE)?	BT-1	Remembering
23.	How does Concurrent Engineering reduce product development lead time?	BT-2	Understanding
24.	What are the major steps involved in the Reverse Engineering process?	BT-1	Remembering
25.	What is the primary objective of Concurrent Engineering?	BT-1	Remembering

	PART-B (16 Marks)			
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1	Explain the Production Part Approval Process (PPAP) in detail, along with its elements.	16	BT-3	Apply
2	Explain the five phases of Advanced Product Quality Planning (APQP) with a neat flow chart. Discuss the activities carried out in each phase.	16	BT-3	Apply
3		16	BT-4	Analyze
4	Explain the importance of Standard Operating Procedures (SOP) in manufacturing industries. Discuss the purpose, contents, documentation, and deployment of SOP on the shop floor.	16	BT-4	Analyze
5	Explain in detail about the procedure for preparing and implementing Standard Operating Procedures (SOP) in a manufacturing organization.	16	BT-3	Applying
6	Explain the working principle of SLA Rapid Prototyping technique with neat sketches.	16	BT-3	Apply
7	Explain the working principle of SLS Rapid Prototyping technique with neat sketches.	16	BT-3	Apply
8	Explain the working principle of FDM Rapid Prototyping technique with neat sketches.	16	BT-3	Applying
9	Explain the working principle of DLP Rapid Prototyping technique with neat sketches.	16	BT-3	Apply
10	Discuss the principles, process steps, advantages, limitations, and applications of 3D printing in engineering product development.	16	BT-3	Apply

11	Explain the concept of Reverse Engineering (RE). Discuss the complete Reverse Engineering process from data acquisition to CAD model generation using a neat flow chart.	16	BT-4	Analyze
12	Explain the concept and principles of Concurrent Engineering (CE). Discuss its role in reducing product development lead time and improving product quality.	16	BT-3	Apply
13	Explain how Reverse Engineering and Concurrent Engineering contribute to New Product Development (NPD). Illustrate your answer with suitable industrial examples.	16	BT-3	Apply
14	Discuss the criteria for selecting an appropriate Rapid Prototyping or 3D Printing process for engineering applications.	16	BT-3	Apply
15	Discuss the stages involved in redesigning an existing component using Reverse Engineering with a neat flow chart.	16	BT-3	Apply
16	Explain the importance of prototype development and validation in New Product Development (NPD). Discuss how Rapid Prototyping, 3D Printing, and Reverse Engineering contribute to prototype evaluation and final product development.	16	BT-3	Apply
17	Explain the role of Reverse Engineering in product redesign and product improvement.	16	BT-4	Analyze
18	Describe the complete workflow of a New Product Development project incorporating APQP, PPAP, SOP, Rapid Prototyping, 3D Printing, Reverse Engineering, and Concurrent Engineering using a neat flow chart.	16	BT-4	Analyze