

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: M.TECH  
BRANCH: PIE**

**SEMESTER : II  
SESSION : SP/2024**

**SUBJECT: PE529 ADVANCED MACHINING TECHNOLOGIES**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a)	Evaluate the importance of advanced machining technologies, considering conventional machining limitations while considering advancements in materials, tool requirements, and intricate product designs.	[5] 2	4
Q.1(b)	Develop a mathematical expression for material removal rate in Abrasive Jet Machining (AJM) specifically tailored for brittle materials.	[5] 1	4
Q.2(a)	You are tasked with manufacturing a critical aerospace component made of titanium alloy. The part features intricate internal channels and complex geometries that require precise machining and finishing. Justify your selection of a specific advanced machining process considering the work materials used and the part features to be produced.	[5] 5	4
Q.2(b)	For Electrochemical Machining (ECM) of pure iron, aiming for a material removal rate of 600 mm <sup>3</sup> /min, calculate the necessary current. Consider the atomic weight of iron as 56, valency as 2, and density as 7.87 g/cm <sup>3</sup> .	[5] 3	3
Q.3(a)	Compare and contrast Laser Beam Machining (LBM) and Electron Beam Machining (EBM), focusing on their working principles, applications, advantages, and limitations.	[5] 1	4
Q.3(b)	You have been assigned the responsibility of producing precision components from a conductive material, such as stainless steel or aluminium alloy. These components necessitate through-cutting of 20 mm thick plates with precision, minimal kerf, perfectly vertical walls, and the highest achievable surface finish. Justify your choice among Wire Electro-discharge Machining (WEDM), Laser Beam Machining (LBM), Electron Beam Machining (EBM), and Plasma Arc Machining (PAM).	[5] 2	4
Q.4(a)	How does Electrochemical Discharge Machining (ECDM) operate? Explain its advantages over EDM and ECM methods.	[5] 4	2
Q.4(b)	Compare the applicability and potential of Laser-assisted Oxygen (LASOX) cutting for cutting thick metals to both laser cutting and flame cutting methods.	[5] 5	4
Q.5(a)	What is Magnetorheological Abrasive Flow Finishing (MRAFF)? Explain its working principle and highlight its advantages in achieving fine surface finishes.	[5] 4	2
Q.5(b)	What is the effect of magnetic field strength, abrasive particle size and concentration, and rotation speed on both the rate and quality of surface finish in Magnetic Abrasive Finishing (MAF)?	[5] 3	3

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