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

CLASS: BTECH **SEMESTER : VII**
BRANCH: PIE **SESSION : MO/2024**

SUBJECT: PE406 NON-CONVENTIONAL MACHINING PROCESSES

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions, each of 10 marks and a total of 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 handbook/Graph paper, etc., to be supplied to the candidates in the examination hall.

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Q.1(a)	Analyze the influence of key process parameters (such as abrasive flow rate, jet traverse rate, mixing ratio and exit pressure) on the surface finish and material removal rate during abrasive waterjet machining (AWJM), using trendlines to support your analysis. How do variations in these parameters affect the machining efficiency and quality of the workpiece?	[5]	3	4
Q.1(b)	Analyze Shaw's Model for calculating the Material Removal Rate (MRR) in Ultrasonic Machining (USM) with the Grain Hammering Model.	[5]	1	4
Q.2(a)	Discuss the various resistances or potential drops that must be overcome for an electrochemical reaction in the Electrochemical Machining (ECM) process to proceed at a steady state when a voltage of 2 to 30 V is applied. Provide a proper illustration to support your explanation.	[5]	2	2
Q.2(b)	In the ECM of pure iron, an MRR of 500 mm^3/min is required. Using the atomic weight of iron (56), its valency (2), and the density of iron (7.8 g/cm^3), estimate the current required for this MRR. Show all calculations involved.	[5]	2	3
Q.3(a)	Compare and contrast conventional EDM and dry EDM in terms of their operational principles, process efficiency, material removal rates, and impact on workpiece quality. Evaluate the advantages and disadvantages of each technique and provide a recommendation for their use in specific manufacturing scenarios.	[5]	5	5
Q.3(b)	Explain the working principle of Wire EDM and how it uses electrical discharges to cut through conductive materials. Describe the role of the dielectric fluid in the process and its effect on the quality of the machined surface.	[5]	1	2
Q.4(a)	Analyze the effects of key process parameters such as laser power, pulse duration, and scanning speed on the material removal rate (MRR) and surface integrity in Laser Beam Machining (LBM). How do variations in these parameters influence the precision of the cut, heat-affected zone, and overall efficiency of the machining process?	[5]	3	4
Q.4(b)	Given a manufacturing scenario where precise drilling of small, deep holes is required on a high-strength titanium alloy for aerospace applications, justify the selection of Electron Beam Machining (EBM) as the most suitable process.	[5]	5	5
Q.5(a)	Explain the working principle of Electrochemical Discharge Machining (ECDM) and describe how the electrochemical and electrical discharges interact to remove material from the workpiece.	[5]	4	2
Q.5(b)	Describe how the Ultrasonic-assisted ECM (USMEC) process combines ECM and USM to effectively machine composite materials, explaining the role of ECM in removing metallic conducting parts and USM in removing nonconducting hard and brittle phases.	[5]	4	2

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