EX/PROD/PC/B/T/323/2024

B. E. PRODUCTION ENGINEERING 3RD YEAR 2ND SEMESTER EXAMINATION, 2024

NON-TRADITIONAL MACHINING

Full Marks:100 Time: Three Hours

Use separate answer script for each Part

Part-I

(60 Marks)

Use Separate Answer scripts for each part.

1. Answer any TEN questions: 10X2 =20
   a) Classify mechanical type non-traditional machining processes.
   b) What are the limitations of Water Jet Machining (WJM)?
   c) What are the process parameters and responses of AWJM?
   d) Mention various units in Abrasive Jet Machining (AJM) system.
   e) What are the limitations of AJM?
   f) Distinguish between LBM and PAM.
   g) What are the lasing mediums used in LBM system?
   h) What are the process parameters used in LBM?
   i) Discuss on different types of abrasives used in USM?
   j) What are the functions of a horn used in USM?
   k) What are the types of transducer used in USM?
   l) What are the types of laser used in LBM?

2. Match the followings: (5x2=10)

Process	Medium	Material Removal Mechanism
USM	1. Air and Abrasives	a. Ablation
LBM	2. Water	b. Plastic deformation and shearing
WJM	3. Abrasive Slurry	c. Micro-chiping and erosion
AJM	4. Mixture of abrasives and water	d. Ductile erosion and brittle erosion
AWJM	5. Erbium	e. Abrasive grain throwing and hammering

2. Answer any SIX questions: 5x6=30
   a) Discuss on material removal mechanism of Ultrasonic Machining (USM).
   b) Discuss about various Laser Beam Machining (LBM) operations with sketch.
   c) Describe the working principle of Nd:YAG Laser beam machining system with sketch.
   d) Distinguish between Transferred Arc and Non-Transferred Arc PAM. Mention various elements of Plasma Arc Machining (PAM) System.
   e) Describe the Electron Beam Machining (EBM) System with Sketch. Why is Vacuum needed in EBM?
   f) Discuss on applications of Abrasive Water Jet Machining (AWJM) process.
   g) Why is USM not used for machining soft materials? What are the various process parameters and machining criteria in USM?
   h) Discuss on similarities and differences of ECM and ECDM.
   i) Discuss on differences and similarities of EDM and WEDM.

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SUBJECT – **NON-TRADITIONAL MACHINING**

Time: Three hours **Full Marks: 100**

Use Separate Answer scripts for each PART

PART- II

Marks: 40

No of Questions		Marks
	Answer Question no. 1 and any two from the following	
1.	Answer the following: (i) Identify major reasons for the development of non-traditional machining (NTM) processes. (ii) Role of electrolyte in electrochemical machining (ECM) (iii) Function of dielectric in electro discharge machining (EDM) (iv) Responsibility of electrolyte in electrochemical discharge machining (ECDM) (v) Differentiate between conventional grinding and electrochemical grinding	2x5
2.	(i) Describe dynamics of ECM process and show variation of inter electrode gap with time for zero feed rate. (ii)The geometry of a copper workpiece surface with single curvature is given by the equation: $y = 10 + 0.3\,x - 0.05\,x^2$, where x and y are in cm. The electrochemical machining process data are as follows: Applied voltage = 15 V, Over voltage = 0.5 V, Tool feed rate (y direction) = 0.6 mm/min Electrolyte conductivity = 0.3 $ohm^{-1}\,cm^{-1}$. Determine the equation of the tool surface geometry.	7 8
3.	(i) For a Relaxation Circuit based EDM operation, deduce mathematical formulations to determine the voltage for the maximum power delivery to the spark gap for the RC circuit is ¾ th of the supply voltage. (ii)A 10 mm diameter hole has to be drilled in a 5 mm HSS sheet by EDM using RC-circuit. The required surface finish is 20 micron. Determine the capacitance to be needed in the circuit when supply and discharge voltages are 220 V and 150 V respectively. The value of the resistance in the circuit is 50 ohm. Also estimate the time required to complete the job,	6 5+4
4.	(i) What is the need of hybrid machining? Classify the types of hybrid machining. (ii)Briefly explain Electrochemical discharge machining (ECDM) process. How is Electrochemical Arc Machining (ECAM) different from ECDM? (iii) Explain Electrochemical grinding (ECG) process. Why is the life of Electrochemical Grinding (ECG) wheel much higher than conventional grinding?	5+5+5