

ENERGY-BEAM PROCESSING OF MATERIALS

(ME – 1019)

Time: 3 hours

Full marks: 70

*Answer any FIVE questions
The questions are of equal value.*

1. (a) Enumerate the Energy-beam processes used in manufacturing industries for various material processing work.
(b) Show the working domain of different energy beam processes in a 'Power density' versus 'Spot diameter' plot.
(c) What are the limitations of conventional thermal processing of materials using a continuous heat source?
2. (a) Show the different pulse shapes used in various pulsed thermal beam processing of materials.
(b) Discuss the effect of pulse duration on thermal distortion of materials during any pulsed energy beam process.
3. (a) With the help of a neat labeled sketch describe the constructional features of an electron beam gun.
(b) Enumerate the applications of EBM.
4. (a) Name the significant properties of laser beam and enumerate the general applications of laser.
(b) Name few lasing medium and draw neat labeled sketches of a solid state laser and a gas laser.
5. (a) State the cut quality characteristics and process characteristics of laser cutting.
(b) Give a comparative list of the different laser cutting methods.
6. (a) State the equation of penetration velocity for vaporization cutting by laser beam.
(b) Write the energy balance equation for fusion cutting (melt & blow) method.
(c) With necessary sketches show how striation and dross formation occur in reactive fusion cutting (melt, burn & blow) method.
7. Write short notes on **any two** of the followings:
 - (i) Process capabilities of Electron Beam Machining (EBM).
 - (ii) Maintaining the vacuum in EBM operation.
 - (iii) Laser cladding.