Indian Institute of Technology, Delhi

Laser systems and applications (PHL 752)

Major

Duration : 2Hrs

Marks : 40

1. Explain the concept of frequency conversion using pulsed laser (as a tunable and/or white light laser) ..... (5 marks)
2. Draw schematic diagram of typical heterojunction (multilayer) laser diode device along with possible energy band diagram explaining the electron/hole transport mechanism. ..... 4 marks
3. Draw the construction of DFB and DBR lasers. ..... 4 marks
4. GaAs material (of length 350 μm) at 300K is injected with excess carriers of concentration $1.75 \times 10^{18} cm^{-3}$. When GaAs *transparency* limit of carrier concentration is $1.25 \times 10^{18} cm^{-3}$ and absorption coefficient is $600 cm^{-1}$, *approximate* the peak gain. ... 3 marks

5. **One word/sentence** answers:
6. (a) Which laser frequency creates (theoretically) less heat affected zone when machining Vanadium ?
   (b) What material removal mechanism happens in lasjk surgery?
   (c) What is hybrid machining?
   d) Name the process in which cells be deposited without being punctured using lasers ....4 marks
7. Explain the pulsed (nano and femtosecond) laser and material interaction at different time scales. Also explain various applications arise at different time scales of such interaction. ...5+5 marks
8. What is the role of laser and optical filters in Raman spectroscopy ? .....4 marks
9. (a) Draw a schematic diagram explaining the working of a free electron laser towards generation of THz pulses. (b) Explain the role of the semiconductor substrate in the detection of THz radiation and draw a schematic for gated THz detection. .....3 +3 marks