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B TECH
(SEM-III) THEORY EXAMINATION 2018-19
LASER SYSTEMS AND APPLICATIONS

Time: 3 Hours *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. What do you understand by Fermi Dirac Distribution function?
b. What is temporal coherence?
c. A laser diode emits 150000 pulses per second. The duration of each pulse is 30ns. Calculate Duty cycle.
d. What is the drawback of Ruby lases?
e. Enlist the difference between Krypton ion laser and Argon ion laser.
f. What are the losses associated in optical communication systems?
g. Why pumping is necessary for laser action?

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. What is black body radiation? On what factors does the black body radiation depend upon?
b. What is optical cavity? Calculate the loop gain, with and without losses for optical cavity.
c. Differentiate between continuous wave laser and pulse laser. Discuss various pulsating technique for a laser.
d. With suitable diagram explain construction and working of Nd:Glass laser.
e. How laser useful in material processing? Discuss laser cutting and laser welding process.

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Explain Bohr's theory of Hydrogen atom. If an electron transit from second orbit to the first orbit. Find the wavelength of electron in Hydrogen atom.
(b) Explain the physical significance of wave function Ψ. Derive time independent Schroedinger wave equation.

4. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Differentiate between spontaneous emission and stimulated emission. The output of a laser has a pulse duration of 60ns and average power is 1watt per pulse. How much energy is released per pulse and how many photons does each pulse contain if the wavelength of laser beam is 6000Å.
(b) What is Q-switched laser? Explain various techniques used in Q-Switching.

5. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Why four level laser systems is more efficient than three level laser system? Find the ratio of population of two energy state of the Ruby laser the transition between which is responsible of photon of wavelength 6928 Å. Assume ambient temperature is 18K.
(b) What are the main components of laser? Briefly explain each component.

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6. **Attempt any *one* part of the following:** 7 x 1 = 7

(a) With suitable schematic diagram explain the working of dye laser. How dye lasers are tuned?

(b) Illustrate construction and working of excimer laser. Enlist the application of excimer laser.

7. **Attempt any *one* part of the following:** 7 x 1 = 7

(a) How are lasers useful in the field of medicine? Briefly explain the application of lasers in Ophthalmology and general surgery.

(b) Discuss the principle of holography. Explain construction and reconstruction of hologram.

Physical Constants

Rest mass of Electron	$m_e = 9.1 \times 10^{-31}$ kg
Rest mass of Proton	$m_p = 1.67 \times 10^{-27}$ kg
Speed of light	$c = 3 \times 10^8$ m/s
Plank's constant	$h = 6.63 \times 10^{-34}$ J-s
Charge on electron	$e = 1.6 \times 10^{-19}$ C
Boltzmann's Constant	$k = 1.38 \times 10^{-23}$ J/K

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