Fourth semester   **B.Tech. [Engg. Physics]**
MAKE UP MID SEMESTER EXAMINATION   (May 2020)
EP-204   OPTICS
Time: 45 min   Max. Marks: 20

Answer all questions

1. A microscope lens of refractive index 1.55 is to be coated with MgF_2 film (n=1.38) to increase transmission of normally incident yellow light (λ= 5500 Aº). What should be the minimum thickness of the film deposited on the lens?

[3]

2. When one mirror of a Michelson interferometer is translated by 0.0114 cm, 523 fringes are observed to pass the crosshairs of the viewing telescope. Calculate the wavelength.

[3]

3. Two light filters are used to transmit yellow light centered around 590 nm. One filter has a broad transmission width of 100 nm, whereas the other has a narrow pass band of 10 nm. Which filter would be better to use for an interference experiment? Compare the coherence lengths of the light from each.

[3]

4. In Young's double hole experiment , interference fringes are formed using sodium light, which predominantly comprises two lines at 5890 A^0 and 5896 A^0 . Obtain the region on the screen closest to the axis where the fringe pattern will disappear. Assume d = 5 mm and D = 20 cm.

[3]

4. A Fabry Perot interferometer is to be used to resolve the mode structure of a He- Ne laser operating at 632.8 nm. The frequency separation between the modes is 150 MHz. The plates are separated by an air gap and have a reflectance (r^2) of 0.999.
a.   What is the coefficient of finesse of the instrument?
b.   What is the resolving power required?
c.   What plate spacing is required?   [4]

5. A single square pulse of amplitude A and duration τ_0 is represented by

$$f(t) = \begin{cases} A & -\frac{\tau_0}{2} < t < -\frac{\tau_0}{2} \\ 0 & elsewhere \end{cases}$$

Using Fourier transform, determine and sketch the power spectrum, locating its zeros. Show that the frequency bandwidth for the pulse is inversely proportional to its duration.

[4]