Total Marks = 100

Problem 1: (a) Unpolarized light with intensity I_o passes thorugh a polarizer and then a secong poalrizer filter (analyzer) with an angle of 30 degrees relative to the first one. What is the intensity of the light as it passes thorough each filter in terms of I_o ? (**15 Marks**)

(b) Unpolarized light with an intensity of 1000 W/m^2 passes through two polarizing filters that are oriented at an angle of 40 degrees to each other. What is the intensity of light that emerges from each filter? (**15 Marks**)

Problem 2: Unpolarized light of intensity I0 is incident on a series of three polarizing filters. The axis of the second filter is oriented at 45 degrees to that of the first filter, while the axis of the third filter is oriented at 90 degrees to that of the first filter. What is the intensity of the light transmitted through the third filter? (**20 Marks**)

Problem 3: No light passes through two perfect polarizing filters with perpendicular axes. However, if a third polarizing filter is placed between the original two, some light can pass. Why is this? Under what circumstances does most of the light pass? (**15 Marks**)

Problem 4: Prove that, if I is the intensity of light transmitted by two polarizing filters with axes at an angle θ and I' is the intensity when the axes are at an angle $90 - \theta$, then $I + I' = I_0$, the original intensity. (Hint: Use the trigonometric identities $\cos(90 - \theta) = \sin\theta$ and $\cos^2\theta + \sin^2\theta = 1$.) (**20 Marks**)

Problem 5: Explain what happens to the energy carried by light that it is dimmed by passing it through two crossed polarizing filters. (**15 Marks**)