INTRODUCTION TO DIGITAL PHOTOGRAPHY

The EXPOSURE TRIANGLE

and

CAMERA EXPOSURE MODES

The Exposure Triangle

What is Exposure in Photography?
In the simplest of terms, exposure refers to how much light is captured by a camera sensor (or film). However, there are many factors that influence exposure.

The Exposure Triangle
The relationship between ISO, Aperture, and Shutter Speed is popularly known as the Exposure Triangle. Knowing how to control or adjust these elements will, under most circumstances, result in well-exposed photos.
Aperture
The aperture is the opening in the center of the lens diaphragm, which is composed of an array of blades that open and close. As these blades open it widens the aperture, and as the blades close the aperture narrows. Adjusting the aperture opening influences the amount of light that reaches the sensor.

In addition to controlling the amount of light that reaches the sensor, adjusting the aperture changes the depth of field, which is the portion of your photo that is in focus. The wider the aperture, the shallower the depth of field. The narrower the aperture, the deeper the depth of field.

Aperture opening size is represented by numerical values called f-stop. A typical range of values for the f-stop are 1.4, 1.8, 2.0, 2.8, 3.6, 4, 5.6, 8, 11, 16 and 22, although there are additional f-stop values at both ends of the range. As the f-stop numerical value increases the aperture becomes smaller, decreasing the amount of light reaching the sensor and increasing the depth of field. Each adjacent f-stop results in either halving or doubling the amount of light that goes
through the camera lens.

An illustration of the diaphragm blades controlling the range of aperture sizes. Wide aperture, with a low f-stop value, on the left. Narrow aperture, with a high f-stop value, on the right.

**Shutter Speed**

Increasing or decreasing Shutter Speed influences two aspects of a photograph. It influences exposure by controlling the length of time that light hits the sensor, and it influences image “sharpness” by controlling how motion is recorded. A fast shutter speed creates a short exposure while, at the same time, “freezing” any motion that may be occurring. A slow shutter speed creates a long exposure while, at the same time, capturing any motion that may be occurring.

Slow shutter speed captures the movement of automobile lights, recorded as streaks of color.
**ISO**

The ISO refers to ratings that define the sensitivity level of your camera sensor (or film) to light. ISO value is represented by numbers: the lower the number, the lower the sensitivity to light and the higher the number, the more sensitive to light. Depending on your camera, the lowest value may be 50, 100, or 200. Each ISO level increase doubles the sensor’s sensitivity (ISO 100 to ISO 200, ISO 200 to ISO 400, and so on), meaning that half the amount of light is need for the sensor to achieve the same exposure.

Digital cameras allow the photographer to adjust the ISO value, increasing or reducing the sensitivity of the sensor. In addition to the amount of light needed for proper exposure, the “quality” of the light that is captured can be controlled, to a degree, by the photographer. For example, a low ISO (100 or lower) will result in more saturation, less noise, and more details. A higher ISO (400 or above) will result in less saturation and less details. Photos taken in low light, such as late evening sky, may require a higher ISO to compensate for the low amount of available light, but that higher ISO may also result in visible “noise”.

**Equivalent Exposures**

The combination of ISO, Aperture, and Shutter Speed settings will produce a particular exposure value. Changing any one of these settings will require adjusting one, or both, of the others to achieve what is called an equivalent exposure value.

For example: If a shot is taken that has the desired tonal range from light to dark, but unwanted motion blur is recorded, then a faster shutter speed can be set to freeze motion. However, this may result in underexposure - unless the aperture is widened or the ISO is increased (or both), to achieve the equivalent exposure value.

Different combinations, while achieving equivalent exposures, will produce different amounts of depth of field (aperture), motion blur (shutter speed), and grain/noise (ISO).

**CAMERA EXPOSURE MODES**

Advanced cameras have a dial, or other method, that is used to select a “mode” that determines which settings are changed manually by the photographer, and which settings the camera will change automatically based on available light. The setup you choose is known as your camera shooting mode or exposure mode. You choose a mode by using the “PASM” dial on most cameras.
A typical PASM dial on an entry-level camera.

On the typical PASM dial, as illustrated above, there are five standard shooting modes available: Program mode, Aperture Priority mode, Shutter Priority mode, Manual mode, and Auto mode.

In addition to the standard shooting modes there may be extra “scene” modes, represented by icons such as those in the illustration above.

P, S, A, and M Modes (Exposure Modes)
Shooting modes fall into three categories: Auto, Scene, and P, S, A, and M. In auto and scene modes the camera determines all settings for proper exposure, based on available light. P, S, A, and M modes, also known as exposure modes, provide a means for the photographer to choose which elements of exposure will be manually controlled.

- **Program Mode** (P on the dial)
The camera automatically adjusts aperture and shutter speed for optimal exposure, but the photographer can choose from different combinations of aperture and shutter speed that will produce the same equivalent exposure. This is known as flexible program.

- **Shutter Priority Mode** (S or Tv on the dial)
The photographer chooses the shutter speed and the camera automatically adjusts aperture for optimal exposure.

- **Aperture-Priority Mode** (A or Av on the dial)
The photographer chooses the aperture and the camera automatically adjusts shutter speed for optimal exposure.

  - **Note:** For all three modes above - P, S, and A - exposure is automatically adjusted for optimal results.
• **Manual Mode** *(M on the dial)*
The photographer chooses both aperture and shutter speed. This provides the greatest latitude for creative expression, but also a greater chance of underexposed or overexposed images.

**What About ISO?**
In most DSLR cameras, the ISO does not automatically change in the above camera modes, it is set manually. If your camera has an “Auto ISO” feature it can be enabled, then set with the desired maximum ISO (example: “800-1600”) and a minimum shutter speed can be set (example: 1/200th of a second). These settings can be manually changed when circumstances dictate.