



### **1 Day Course on Interior Lighting Design (Part 1: Fundamentals of Interior Lighting Design)**

by Dr Siow Chun Lim

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On 30 October 2018, the Electrical Engineering Technical Division (EETD) successfully organised a 1-day course on “Interior Lighting Design” at Wisma IEM. It was the first event EETD co-organised with MyCIE and TEEAM. The speakers were Mr. Narendren Rengasamy and Mr. Glenn Tiong. The seminar was well attended by more than 40 participants.

The first speaker, Mr. Narendren gave a brief introduction of TEEAM and MyCIE. He then introduced his topic “Fundamentals of Interior Lighting Design”. He said: “Human eye is not equally sensitive to visible light of all wavelengths despite them being in the same range of electromagnetic spectrum”. The terminologies of scotopic and photopic were introduced. Radiometry measures all wavelengths of light equally whereas photometry measures the visible light energy based on the human eye sensitivity curve.

Briefly Mr Narendren’s talk covered six areas: Units of measurement; colour quality; light sources; discharge types; LED lighting; and luminaires.

**Units of measurement.** Luminous flux also known as lumens measures the total light output from the source. Illuminance on the other hand quantifies the light incident on surface and is described in lux. Hence, lux is actually lumens per meter square. Luminance intensity quantifies light in a given direction described in candela (cd) whereas luminance, often termed as brightness quantifies the direct or indirect light transmitted in the direction of an observer from a flat surface described in candela per meter square. Correlated colour temperature (CCT) which is measured in Kelvin, is defined by the proximity of the light source’s chromaticity coordinates to the blackbody locus. It basically defines how warm or cool white light looks like.

**Colour quality.** Colour quality can be equated to a matrix which defines how well colour is perceived under the light source. There are a few measures of colour quality which include colour rendering index (CRI), colour quality scale, feeling of contrast index (FC), gamut area index, R9 content, television lighting consistency index (TLCI), below black body locus (BBL) and IES TM-30 which works similarly with CRI but uses 99 colour palettes instead of 8.

**Light sources.** Light sources can be natural or artificial. Electrical lighting is one of the most common form of artificial lighting. The electrical lighting industry has evolved from the primitive incandescent technology to discharge type before subsequently morphed forward to solid state lighting, or more commonly known as LED lighting. These evolutions have brought about efficacy improvement but at increased manufacturing cost and complexity.

**Discharge types.** Discharge lighting at low pressure generates light in 2 stages. At switch on, an arc is initiated which generates Ultra Violet which in turn reacts with the coating to generate white light. This technology radiates less heat and has better efficacy compared to its incandescent predecessor. However, it requires certain start-up time. Switching losses as well as frequent switching tend to reduce its lifespan. The light output is directly affected by the ambient temperature.

**LED lighting.** LED lighting could be radial type or surface mounted devices. The energy loss due to the recombination of holes and electrons at the p-n junction appears in the form of heat and light. Mr. Narendren quipped that LED may not be a totally green technology as it requires phosphor which is a rare earth material. The main criteria of performance of solid state lighting includes brightness, colour tolerance and forward voltage. LED's are current driven device and its lumens tend to drop as the junction temperature increases due to forward voltage drop.

**Luminaires.** Luminaires may be classified according to the lighting effect i.e. whether it is meant for specific or general location. Light distribution curves (LDC) may be LDC polar which graphically represents the light distribution in a horizontal or vertical plane, LDC linear which indicates the distribution of luminous intensity in candelas of the luminaire or the cone diagram which indicates the maximum illuminance at different distances away from the source. IP ratings of luminaires is a major concern while IK ratings is of concern mainly for outdoor lighting.



Token of appreciation to Mr. Narendren