MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIFTH YEAR EXAMINATION FOR BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING

EEE 535: ILLUMINATION ENGINEERING

DATE: 20/12/2017 **TIME: 8.30-10.30 AM**

INSTRUCTIONS: This examination paper contains five questions. Answer **Question ONE** and any other **TWO Questions**. Question ONE carries 30 Marks and ALL the other questions carry 20 Marks each.

QUESTION ONE (COMPULSORY)

a) Define the following terms as used in the illumination engineering

i. Illumination or illuminance (2 marks)

ii. Reduction factor (2 marks)

b) A corridor is lighted by 4 lamps spaced 10 m apart and suspended at a height of 5 m above the centre line of the floor. If each lamp gives 200 C.P. in all directions below the horizontal, find the illumination at the point on the floor mid-way between the second and third lamps. (7 marks)

c) A lamp giving out 1200 lm in all directions is suspended 8 m above the working plane. Calculate the illumination at a point on the working plane 6 m away from the foot of the lamp (5 marks)

d) Find the total saving in electrical load and percentage increase in illumination if instead of using twelve 150 W tungsten-filament lamps, we use twelve 80 W fluorescent tubes. It may be assumed that

(i) there is a choke loss of 25 per cent of rated lamp wattage (4 marks)

(ii) average luminous efficiency throughout life for each lamp is 15 lm/W and for each tube 40 lm/W and (2 marks)

(iii) coefficient of utilization remains the same in both cases (2 marks)

e) What are the six classification of the lighting schemes? (3 marks)

f) What are the typical applications of a mercury vapour lamps (3 marks)

QUESTION TWO (20 MARKS)

a) i) Give a definition of the utilization factor/Coefficient of utilization (2 marks)

ii) What are the four factors that determines the utilization factor (4 marks)

iii) A production area in a factory measures 60m x 24m**.** Find the number of lamps with LDL output of 18,000lumens needed to produce and illuminance of 300lux if the utilizations factor is 0.45 (4 marks)

b) A show case is lighted by 4 metre of architectural tubular lamps arranged in a continuous line and placed along the top of the case. Determine the illumination produced on a horizontal surface 2 metres below the lamps in a position directly underneath the centre of the 4 m length of the lamps on the assumption that in tubular lamps emit 1,880 lm per metre run. Neglect the effect of any reflectors which may be used. (10 marks)

QUESTION THREE (20 MARKS)

a) Give four advantages of a start-less method used in fluorescent **circuit** (4 marks)

b) Correction of colour distortion can be achieved by? (2 marks)

c) Estimate the number of 1000-W floodlight projectors required to illuminate the up per75 m of one face of a 96m tower of width 13 m if approximate initial average luminance is to be 6.85 cd/m2. The projectors are mounted at ground level 51m from base of the tower. Utilization factor is = 0.2; reflection factor of wall = 25% and efficiency of each lamp = 18 lm/W (7 marks)

d) A small light source with intensity uniform in all directions is mounted at a height of 10 metres above a horizontal surface. Two points A and B both lie on the surface with point a directly beneath the source. How far is B from A if the illumination at B is only 1/10 as great as at A? (7 marks)

QUESTION FOUR (20 MARKS)

a) An incandescent lamp has a filament of 0.005 cm diameter and one metre length. It is required to construct another lamp of similar type to work at double the supply voltage and give half the candle power. If the new lamp operates at the same brilliancy, determine suitable dimensions for its filament. (10 marks)

b) A 60-candle power, 250-V metal filament lamp has a measured candle power of 71.5

candela at 260 V and 50 candelas at 240 V.

(i) Find the constant for the lamp in the expression $C = aV^b$ where C = candle power and V = voltage. (5 marks)

(ii) Calculate the change of candle power per volt at 250 V. Determine the percentage variation of candle power due to a voltage variation of æ 4% from the normal value (5 marks)

QUESTION FIVE (20 MARKS)

a) Two lamps A and B of 200-candela and 400-candela respectively are situated 100 m apart. The height of A above the ground level is 10 m and that of B is 20 m. If a photometer is placed at the centre of the line joining the two lamp posts, calculate its reading (10 marks)

b) A perfectly diffusing surface has a luminous intensity of 10 candles at an angle of 60º to the normal. If the area of the surface is 100 cm2, determine the brightness and total flux radiated. (5 marks)

c) A drawing office containing several boards and having a total effective area of 70 m2 is lit by a number of 40 W incandescent lamps giving 11 lm/W. An illumination of 80 lux is required on the drawing boards. Assuming that 60% of the total light emitted by the lamps is available for illuminating the drawing boards, estimate the number of lamps required. (5 marks)