IEG 201 Engineering Systems

**Time: 180 minutes**   **Total marks: 90 marks**

Note1: If need, make suitable assumptions and state it clearly when answering

Note2: Part I, II and III carry 5, 7 and 8 marks respectively

Part I

→ 1. What scheme you would adopt for promotion of retrofitting? ✗

2. Design an interaction system to update wrong entry in AADHAR card by using HIS tools →

3. What are the considerations to be taken while placing the sensors. Brief yet precise.

→ 4. Can you think of few mobile apps that would be relevant for an autonomous/human in loop vehicle? ✗

5. What is the difference between earthquake magnitude and intensity?

6. List out various human interface classes and explain them ✗

→ 7. Calculate the minimum altitude angle of the Sun above which the direct solar radiation will not reach the lux sensor in the room section given below.

Roof 0.5 m
0.5
Overhang
South wall
Window
3 m
1.5 m
Lux Sensor
0.5 m
North
0.8
3 m
Floor
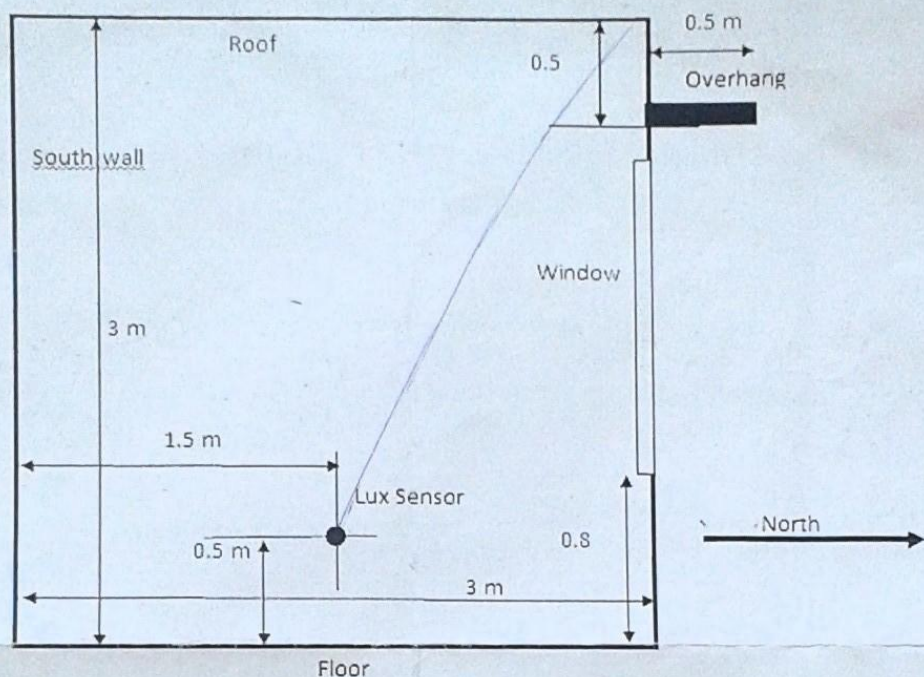
If the room's window is facing North, above what latitude in the Northern Hemisphere, the sun will never enter through the window at noon? (3 M)

What are the different types of motion sensors and how do they work? (2 M)

Part II

8. An autonomous driving system is being developed a) Explain the sensors required and justify briefly.   b) The considerations involved in designing a software architecture

Part III

9. Explain the procedure for seismic evaluation of a heritage building (like the Salarjung Museum) and mention the components of SoI & operating environment highlighting the interfaces that are different from a standard RC building.

10. Explain the kit requirement during any disaster in detail and draw an escape plan for top floor in Himalaya building during fire accidents. Assume there are 2 different types of users/stakeholders.

$\frac{4 \times 9 d}{10 g}$ = ㉖

㊀

$\frac{100 - 40}{9}$ 90 ㉜

11. (Answer any two below)

a. What strategies should be used for reducing the heat gains from the roof in Hot and Dry climate? Draw the roof cross section and explain the impact of the different layerson reducing the heat ingress. (4 M)

b. Consider a room windowless of 4 m × 4 m × 4 m. Assume inside temperature of the room is to be 25°C and outside temperature to be 45°C. Calculate the required U value of external wall if total gain from the extremal wallsisto be limited to 1000 W.

Calculate required thickness of insulation to achieve required U-value of external wall, if XPS insulation (k-value 0.0307 W/m-K) is proposed with 0.25 m Brick (k-value 0.82 W/m-K). (4 M)

c. Write down the importance of glass visible light transmittance and solar heat gain coefficient. What should be the ratio of light to solar heat gain for a high performance glass in Hot and Dry climate? (4 M)

12.) List steps in design of an engineering system. You are asked to design an autonomous vacuum cleaner which is affordable to an average income earning Indian. For the given problem, define and justify Goal statement, list and justify the ideal performance specifications, and propose an initial solution/design through ideation.   List   and   justify   different   subsystems   required.

13.) The institute is planning to put in a student placement system that makes sure that there is least disturbance to the regular academic work on the campus. a) Mention all the different stakeholders and their roles

b) using a block diagram or use case, explain how the subsystems can interact keeping their limitations in mind.

14.) What is a control system? Draw schematic and explain about how the flow of steam is controlled in a steam engine to maintain desired flywheel speed at the output end. Is this system 1) manual or automatic control and 2) open-loop or closed-loop control?. Justify your answer. Identifying different components of this control system and draw block diagram.