2CHOE26 Introduction to Fire and Safety Engineering (Open Elective)

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2CHOE26 Introduction to Fire and Safety Engineering

- **Course Learning Outcome:**
- At the end of the course, student will be able to-
- explain the fire process and its chemistry
- choose fire protection system and extinguisher
- analyze fire accident
- compare fire insurance and policies

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- **Syllabus:**
- **Introduction**
- Fire in history, fire losses, fire causes, interested parties in fire safely, fire protection standards and practice, how much safety is enough?
- **The Fire Process**
- Introduction, fire triangle, fire tetrahedron, fuels, smouldering, metal fires, combustion of dusts, ease of ignition, heat, ignition processes, thermal feedback, fire stages, structure of flames, flame height/length, fire plume, plume features, flame progression.

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- **Syllabus:**
- **Chemistry of Fire**
- Matter around us, avogadro's hypothesis, work versus energy, energy in chemical reactions, oxidation and reduction, chemical chain reaction in fire, flame chemistry, reducing atmosphere, vapor pressure of liquids, flammability limits and flammable range, estimating lower flammability limit (LFL), flash point, fire point, ignition point, ignition energy, Different type of combustion processes (Rapid, Spontaneous, Explosive combustions)

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- **Syllabus:**
- **Heat Transfer in Fires**
- Fundamentals of heat, heat transfer and heat flux, modes of heat transfer, temperatures versus heat in fire, severity and growth of fire, spontaneous heating and spontaneous combustion, heat release rate
- **Fire Detectors and Alarms**
- Introduction, basics of detectors and alarms, detector types based on effects, heat detectors, smoke detectors, optical flame detectors, gas-sensing detectors, application-specific detectors, selection of detectors, alarm systems, fire alarm systems and control panel, principle of operation, selecting detectors and alarm systems

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- **Syllabus:**
- **Fire Extinguishers**
- Fire fighting fundamentals, first-aid fire fighting extinguishers, common features of extinguishers, types of extinguishers, classification of fires (Class A, B, C, D, E and F) and suitability of extinguishers, rating of extinguishers, hazard categorization and placement of extinguishers
- Practical demonstration and Revision

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- **Syllabus:**
- **Fixed Fire Protection Systems**
- Introduction, water-based fixed fire protection systems, automatic sprinklers, foam systems, water spray systems, water mist systems, carbon dioxide flooding systems, clean agents, draining out fire water
- **Risk Management and Fire Insurance**
- Origins of general insurance and emergence of risk management, hazard versus risk, hazard identification and analysis, risk assessment and control, principles of insurance, fire insurance policy, covers available, insurance value, reinsurance, emergency preparedness, features of emergency plans, line of action.

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- **Syllabus:**
- **Investigating Fire Incidents**
- Background to fire investigation, practice of investigation, arson, who should investigate fires?, when should an investigation begin?, evidence, witnesses, bum patterns, sketches. Photographs and diagrams, material or sequence evidence, records or paper evidence, interpreting evidence and report writing, 'electrical ' fires

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- Das, Akhilkumar, *Principles of Fire safety engg*, PHI publication
- *Handbook of Fire and Explosion Protection Engineering Principles*, William Andrew an imprint of Elsevier
- *Fire Hazards in Industry*, Norman Thomson, Butterworth-Heinemann is an imprint of Elsevier.
- Robert Burke, *Fire Protection Systems and Response,* CRC Press
- John A. Purkiss, *Fire Safety Engineering Design of Structures.* Butterworth-Heinemann is an imprint of Elsevier
- R. Craig Schroll, Industrial Fire Protection Handbook, CRC Press

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Fire: A rapid chemical process (combustion) that produces heat and light

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- Fires are destructive, spreading as they grow and consuming the evidence of their initiation.
- One must always determine the cause of the fire, whether arson or accidental, in order to identify hazards and dangerous practices and prevent future fires.

What Is Fire Made Of?

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- ***The fire accident at Serum Institute of India caught the media & public attention as SII is playing a significant role in the manufacture of COVID-19 vaccines.***
- ***Data available with the NCRB indicates that the number of fire accidents in the country reduced by over 40% between 2015 & 2019. The number of deaths per year is still above 10,000***

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- **Number of Fire Accidents & Loss of life show a declining trend over the years**
- **2019: 11037 accidents: 10915 death**
- **2015: 17700 death**
- deaths caused due to fire accidents i.e., a decline of 38% of the five-year period.
- The number of such reported fire accidents fell by around 16% compared to 2018. The decline was more steeped compared to the year earlier, which was around 2%.

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- **Fire accidents in Residential Buildings form the major portion such accidents**
- In 2019, out of the 11,037 Fire Accidents, a total of 6,364 accidents i.e., around 57% occurred in Residential Buildings.
- Over the five-year period, the proportion of fire accidents in Residential buildings out of total fire accidents increased from around 40% in 2015 to 57.6% in 2019.
- **Electrical Short Circuit & Cylinder/Stove burst are the major causes for fire accidents**

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- **There is a need to improve Fire Safety standards in Residential places**
- The higher deaths due to “Gas Cylinder/stove burst” can be attributed to the challenges in ensuring fire-safety measures.
- Numbers also indicate that the number of women victims is comparatively higher, further highlighting the risk at residential places and their exposure to the same.
- a news report claims that India recorded around 27 thousand of the 1.2 lakh deaths reported globally in 2017 due to fire accidents.
- This is a staggering 22.5% of the global total. As per this report, India accounts for 17% of the Global fire accidents.