

GAUTAM BUDDHA UNIVERSITY

Course Name: RAMS Advanced

Course Credit: 04

Total Contact Hours: 60

| S No | Topics | Total Hours: 60 |
|-------------|--|------------------------|
| 1 | Review on Basic RAMS module | 2 |
| 2 | System Reliability Modelling and Evaluation Techniques: Advance | 6 |
| | Standby/Partial Standby model, Load Sharing Model, Tri-State Model., Reliability modeling for repairable components | 6 |
| 3 | Interference Theory and Stress-Stress Models | 6 |
| | Interference Theory and Reliability Computation: General expressions, Reliability Computation for different types of similar/dissimilar stress-strength distributions, Graphical Approach. | 4 |
| | Physics of Failure (Interference Theory and Stress-Strength Models, Time Dependent Stress Strength Model (advance), Degradation Analysis) | 2 |
| 4 | Time Dependent Stress Strength Model | 4 |
| | SS Classification, reliability computation for Deterministic/Random Cycle times, Reliability in case of aging, cyclic damage, and cumulative damage. | 4 |
| 5 | Maintainability & Testability Analysis, Availability Modeling | 6 |
| | Markov State Model for non-maintained/maintained Systems: Reliability/Availability Modelling for single unit, standby, two units with/without joint servicing. Markov models advantages and limitations. | 6 |
| 6 | Fault Tree Analysis | 6 |
| | Definitions and Symbols, Construction, Simplification | 2 |
| | Fault tree evaluation: Qualitative and Quantitative | 2 |
| | Event Importance Measures: Birnbaum, Vesely-Fussel etc. | 2 |
| 7 | Special Systems Models and Reliability Evaluation | 6 |
| | Phased-mission Systems, Common-cause Failure Modelling, Introduction to Multistate Systems. | 6 |
| 8 | Reliability Testing and Demonstration | 8 |
| | Types of Reliability Testing, ALT, HALT and HASS models (overview) (Statistics, Physics-Statistics, Physics-Experimental based models), in-service reliability demonstration with consumer & producer's risk, field reliability demonstration. | 3 |
| | Degradation Models, Basic ALT plans. | 3 |
| | 4 Industrial Case Studies- Telecom, Medical, Electronics and Defense | 4 |
| 9 | Fault Tolerance for enhancement of Reliability & Safety | 8 |
| | Safety Assessment and safety approval, cross approval processes Fault Tolerance Case Studies: Aerospace and Railway | 8 |

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| 10 | Commonly used RAMS standards Industrial Case Studies from Railway, Defence and New Product Development and xxx) | 8 |
| | MIL XXXX, IEC, ARP, SAE, EN, ISO, CENELEC, SIL etc. | 8 |

References and Textbooks

Maintainability and Testability definitions and Acronyms

1. International Electrotechnical Vocabulary: Dependability and Quality of Service, IEC-60050-192 (2015)
2. P. DERSIN & R. Valenzuela, Designing for Availability in Systems and Systems of Systems, Annual Reliability & Maintainability Symposium (Tutorial given at RAMS 2020)

Reliability Demonstration

1. Reliability Testing-Compliance Tests for Constant Failure Rate and constant Failure Intensity, 2d Edition, IEC 61124, Geneva, 2006
2. MIL-HDBK-781 A: Handbook for Reliability Test Methods, Plans and Environments for Engineering, Development Qualification, and Production, US Dept of defence, Arlington, VA, 1996.
3. P. Dersin and C. Maiorano, Methods for RAM Demonstration in Railway Projects, Chapter 10, Handbook of RAMS in Railway Systems, CRC Press, 2018.

General

1. Walpole R. E., Myers R. H., Myers S. L., and Ye K, "Probability & Statistics for Engineers and Scientists", 9th edition, New York; Prentice Hall, 2012.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw-Hill.
3. Elsayed A. Elsayed, "Reliability Engineering", 2nd ed., John Wiley & Sons, Inc.
4. Kapur K. C. and Lamberson, L. R., "Reliability in Engineering Design", Wiley India Pvt. Ltd., 2009
5. Kececioglu D. B., "Reliability Engineering Handbook, Vol. 1 and 2", DEStech Publications, Inc.
6. Birolini, Reliability Engineering, Theory & Practice; 8th Edition, Springer, 2017 (Ch. 7 on reliability demonstration)