TRF RECRUITMENT 2022

SYLLABUS STUDY, REFERENCES, FOR MCQ TEST & INTERVIEWS

MECHANICAL DOMAIN

For Second Year and Third Year Students

I. Mechanical Components in Robotics

1. Fasteners - Nuts, Bolts, studs, Screws, Rivets, Washers
2. Bearing and their types
3. Coupling and their types
4. Types of Wheels for Locomotion
5. Springs and their types`

II. Power Transmission

1. Gears and Gear Trains
2. Belt & Pulley
3. Chain & Sprockets
4. Rotary to Linear Motion

III. Units, Dimensions, Scalar & Vector Properties Accuracy

IV. Robot Mechanics

1. Force
2. Torque
3. Equilibrium
4. Free body Diagrams
5. Friction
6. Centre of Gravity
7. Centre of Mass

8. Centroid and moment
9. Concept of Roll, Yaw, Pitch

V. Projectile Motion

VI. Circular Motion.

VII. Rotational Motion

VIII. Work, Energy, Momentum & Collision

IX. Material Properties and Selection of Material

1. Elasticity, Ductility, Malleability
2. Stress & Strain
3. Hooke's Law
4. Stress-strain diagram

X. Robot Kinematics

1. Degree of Freedom
2. Kinematic linkages
3. Forward & inverse kinematics

XI. Types of Actuators and its Applications

1. Motors - Construction, Working & Application:
   i. PMDC
   ii. BLDC
   iii. Stepper Motor
   iv. Servo Motor
2. Pneumatics and its applications

For Third Year Students

I. Design of Machine Elements

1. Design of Springs
2. Design of Gears

II. Selection of Belt, Chain, Rope Drives

III. Factor of Safety

IV. Limits, Fits & Tolerances

V. Manufacturing Processes

1. Casting
2. Welding, Brazing, Soldering
3. Sheet Metal working
4. Machining Processes
5. Additive manufacturing
6. Laser Beam Machining
7. Conventional and Non-Conventional Machining
8. Water jet cutting

VI. Inversion of mechanisms

1. Slider crank mechanism
2. Four bar mechanisms

VII. Strength of Machines

1. Torsion
2. Principle Stresses and Strain
3. Theory of Failures
4. Bending Stress
5. Bolted Joints

VIII. Engineering Drawing

1. Orthographic Projections & Isometric Projections
2. Projection of lines
3. Projection of planes
4. Symbols

Real life applications and latest technical developments in above topics are expected to be known

REFERENCE FOR STUDY MATERIAL

I. Theory of Machines, R.S. Khurmi and J K Gupta; Multicoloured edition; S. Chand Publication
   1. Chapter 1 – Units, Dimensions, Scalar & Vector Properties
   2. Chapter 3 – Kinetics of motion
   3. Chapter 4 – Simple Harmonic Motion
   4. Chapter 5 – Simple Mechanisms
   5. Chapter 11 – Belt and chain drives
   6. Chapter 12 – Toothed gearing
   7. Chapter 13 – Gear trains

II. Theory of Machines, S. S. Rattan; 4th Edition; Tata McGraw Hill
   1. Chapter 1 – Mechanism and Machines
   2. Chapter 10 – Gears
   3. Chapter 11 – Gear Trains

III. Design of Machine Elements 3rd edition, V. B. Bhandari
   1. Chapter 3 - Limits, Fits & Tolerances
   2. Chapter 4 – Factor of safety, Torsion, bending, Stress theories
   3. Chapter 7 – Threaded joints
   4. Chapter 8 – Welded joints
   5. Chapter 9 – Shaft, key and Couplings
   6. Chapter 10 – Springs
   7. Chapter 13 – Belt drives
   8. Chapter 14 – Chain drives
   9. Chapter 15 and 16 – Bearings

IV. Engineering Drawing 50th Edition, N. D. Bhatt, Charotar Publication.

V. Engineering Drawing 2nd Edition, C. M. Agarwal, Basant Agarwal, Tata McGraw Hill Education Pvt. Ltd., New Delhi

VI. A Textbook of Engineering Mechanics, R.S Khurmi, S. Chand Publications
   1. Chapter 2 – Composition & Resolution of Forces
   2. Chapter 5 – Equilibrium of Forces

3. Chapter 6 – Centre of Gravity
4. Chapter 7 – Moment of Inertia
5. Chapter 9 – Principle of Friction
6. Chapter 20 – Projectiles
7. Chapter 21 – Motion of Rotation
8. Chapter 23 – Simple Harmonic Motion

VII. Strength of Machines Vol. I – Statics, Dynamics, 9th Edition, F. P. Beer and E. R. Johnston (2011), Tata McGraw Hill.

1. Chapter 1 - Introduction - Concept of Stress
2. Chapter 3 – Torsion
3. Chapter 4 – Pure Bending
4. Chapter 7 - Transformations of Stress and Strain
5. Chapter 8 - Principal Stresses under a Given Loading

VIII. Krishna Kumar Dwivedi and Mukesh Pandey, Fundamentals of Systems Engineering, Wiley, ISBN-13: 978-8126566549

IX. Benjamin S. Blanchard and Wolter J. Fabrycky, Systems Engineering and Analysis, 5th ed., PrenticeHall International Series in Industrial and Systems Engineering, (Upper Saddle River, NJ), 2006. ISBN-13: 978-0-13-221735-4

X. R. K. Mittal, I. J. Nagrath, Robotics and Control, Tata McGraw Hill Publication

XI. Gears
https://khkgears.net/new/gear_knowledge/introduction_to_gears/types_of_gears.html

XII. Wheels
http://www.robotplatform.com/knowledge/Classification_of_Robots/Type s_of_robot_wheel s.html