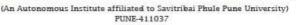


## Bansilal Ramnath Agarwal Charitable Trust's

#### Vishwakarma Institute of Technology





# THE ROBOTICS FORUM

# 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/type s\_of \_gears.html

#### XII. Wheels

http://www.robotplatform.com/knowledge/Classification\_of\_Robots/Ty pe s\_of\_robot\_wheel s.html