TEAM ASTRA

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

DFMEA REPORT

S No.	DEPARTMENT	NAME OF COMPONENT	OCCURENCE MODE	EFFECT OF FAILURE	FAILURE CAUSE	ACTION TO BE TAKEN
1	**Roll Cage**	**Tube**	• Bending and Fracture. • Failure in Structure.	• Damage the Roll cage of vehicle. • Leads to risk human life.	• Heavy loads applied on the tubes. • Improper selection of tube pipes.	• Effective analysis to be performed. • Coating can be done in surface to avoid rusting. • Routine testing to be performed. • High Factor of Safety.
		Edges	• Crack at edges.	• Alligatoring.	• Improper Manufacturing.	• Trimmimg operation removes the edge cracks.
		Weld Joints	• Fracture in the joints. • Wrong filler material.	• Impact of heavy loads. • Change in Material properties due to weld.	• Pores formed inside the weld. • Mismatch in weld joints. • Sharp Under cut and overlap at the weld toe. • High voltage and and high hrat cause deformation in material.	• Maintaining Carbon Content. • Avoide fillings through proper welding. • Remove impurities of metal before Welding. • Using an correct angle for weld, maintaining perfect temperatures to prevent burn through and to promote complete weld penetration.
		Mounting tabs for other components	• Breakage of tabs.	• Flapping or ripping off of components.	• Heavy Wind resistance. • Quality of Materials. • Improper fasteners.	• Proper selection of Materials.
2	**Suspension**	**Springs**	• Fracture of springs. • Buckling.	• Damage of control arms. • May lead to crashing of vehicle due to sudden change in handling. • Damage of Dampers.	• Poor quality of material. • Improper manufacturing techniques. • Corrosion in springs due to absence of protective coatings.	• Proper selection of materials. • Employing proper slenderness ratios during design and manufacturing. • Performing good preventative maintenance practises.
		Dampers	• Formation of froth in suspension fluid. • Leakage of seals.	• Improper handling. • Bouncy or wobbly suspension. • Possibility of crash by loss of traction, due to leaking fluid.	• Insufficient damper heat transfer capacity. • Cracking of seals.	• Proper selection and purchase of Dampers.
		Control Arms	• Fracture of control arms.	• Sudden shock on the entire suspension system and the driver. • May lead to accidents, due to sudden change in handling.	• Poor quality of material. • Improper manufacturing techniques. • Corrosion in control arms due to absence of protective coatings.	• Proper selection of materials. • Proper welding and performing good preventative maintenance measures.

		Knuckles	• Fracture of suspension knuckles.	• Sudden shock on the entire suspension system and the driver. • May lead to accidents, due to sudden change in handling.	• Poor quality of material. • Improper manufacturing techniques. • Corrosion in knuckles due to absence of protective coatings.	• Proper selection of materials. • Proper welding and performing good preventative maintenance measures.
		Wheel bearings	• Worn out bearings.	• Reduced performance of the vehicle. • Improper tire alignment. • Unpredictable handling. • Additional stress on the drivetrain (Motor, CV joints, Chain and Sprockets). • Possibility of siezing up movement of the respective tire.	• Poor quality / over-used bearings may cause premature wearing out of the bearings. • Exposure to rough weather, may cause corrosion within the bearing internals.	• Proper selection and purchase of Bearings.
		Bushings	• Worn out bushings.	• Loose, unresponsive suspension characteristics. • Poor handling of the vehicle. • Unwanted play in suspension components.	• Poor quality / old bushings.	• Proper selection and purchase of Bushings.
		Suspension mounts	• Breakage of mounts.	• Sudden shock on the entire suspension system and the driver. • May lead to accidents, due to sudden change in handling.	• Poor quality metal / improper welding. • Corrosion in suspension mounts, due to absence of protective coating.	• Proper selection of materials. • Proper welding and performing good preventative maintenance measures.
3	**Wheels and Tires**	**Wheels**	• Cracking of spokes.	• Sudden shock on the entire suspension system and the driver. • May lead to accidents, due to sudden change in handling. • Possiblity of bursting of tires, which may result in an accident.	• Poor quality wheels. • Excessive internal stresses, due to overtorquing of lug nuts.	• Proper selection and purchasing of wheels. • Avoiding overtorquing of lug nuts.
		Tires	• Bursting of tires.	• Sudden shock in vehicle handling, which may result in an accident. • Immobilization of the vehicle, in the event of a failure.	• Poor quality / old, wornout tires. • Excessive tire pressures.	• Proper selection and purchasing of tires. • Inflating tires to their proper tire pressures.
4	**Brakes**	**Rotors**	• Wear and tear of disc. • Corrosion on lines and pads.	• Inefficient braking distance. • Noise creation. • Lead to accidents.	• Poor Quality of material. • Riding in offroad and mud. • Thermal distribution.	•Good quality of disc material. •Selection of right disc for thermal distribution. •Proper fiiting must be done in order to avoid stress concentration factors.
		Calipers	• Damage of brake pads while locking. • Uneven flow inside caliper. • Overheating.	• Skidding of wheel. • Locking of brake pads. • Low coefficient of friction.	• Low quality brake pads. • Improper brake force. • Thermal overload.	• Proper brake force distribution. • Good quality of brake pads. • Selection of right caliper according to the applied brake force.

		Brake Lines	• Damage caused due to environmental conditions. • Improper flow due to the deformation of the line.	• Damage of whole transmision circuit. • Leads to leakage • Reacts to the oil present inside the line.	• Improper selction of brake line material. • Inferior wall thickness. • Unordered flow of oil through an rapid pathway.	• Mounting of lines with proper clamps . • Selection of brake line which withstands external conditions. • Checking the flow rate before fitting it into the joints.
		Master Cylinder	• Seals inside of the cylinder can wear out.	• Difficulty in stopping the Vehicle. • Pedals feels mushy or Spongy • Pedal sinks to the Floor.	• Continuous use of Brake.	• Good quality of Brake Fluid must be used. • Cylinder must be install with proper Bleeding.
		Brake Reservoirs	• Damage to the Plastic Reservoir. • Fluid level Sensor Malfunction.	• Inability to know the Brake Fluid Levels. • Chances of Total Brake System Failure.	• Misaligned or Corroded Brake Calipers. • Improperly installed Wheel bearings.	• Quality products should be used. • Practising Preventative Maintenance.
		Hydraulic joints	• Leakage occurs on nodes. • Leakage on internal thread of brake line.	• Possibility of getting detached while braking, which may lead to accidents. • Internal blockage due to dust particles.	• Improper fittings of bolts and wasers. • Uncleaned surface of bolt and thread.	• Proper cleaning of surfaces of bolts and threads. • Using of necessary washers in the areas of clearance.
		Brake over travel switch	• Improper fiiting of BOT switch below the pedal	•Lead to accidents. •Condition of brake is not known.	• Solid state of kill switch without making contact. • Electrical shortages inside the switch. • Distance not measured from the pedal for proper fixing.	• Proper fixing of BOT switch below the pedal. • Checking the condition of wiring by continuity test at rest position. • Applying maximum force to check the certainity of activation.
5	**Transmission**	**Chain**	• Noise between the link pins. • Breakage in chain.	• Operability is reduced. • Sagging.	• Insufficient lubrication of chain-sprocket drive. • Improper mounting.	• Mount all parts carefully & rigidly with primary members. • Chain drive arrangement should not be horizontal/vertical completely. • Proper lubrication and peroidic maintenance.
		Sprocket	• Vibration in the sprockets. • Breakage of sprocket teeth.	• Abnormal behaviour of kart • Possible immobilization of the vehicle.	• Vibration is due to undercut in sprockets. • Due to, lack of lubrication between chain and sprockets.	• By eliminating the undercuts, vibration can be reduced. • Proper lubrication and preventative maintenance measures should be followed regularly.

		Axle Shaft	• Metal failure. • Fracture and twisting of shaft.	• Transmission system will be collapsed. • Torsional stress.	• Due to excessive rotary bending. • Incorrect finish of shaft. • Misalignment of shaft.	• Do the proper design and manufacturing. • Careful machining and assembly. • Measurement and correction of torsional variations. • Changing the natural frequencies of the system.
		CV Joint	• Crack in boot. • Noise in CV.	• Foreign particles like water and dirt enter through crack. • The CV joint will wear out and eventually fail. • A badly-worn outer CV joint can even disintegrate while driving.	• Leakage of grease.	• Simply replacing the boot and replacing the CV joint with fresh grease. • Replacing with new joint.
6	**Steering**	**Rack and Pinion**	• Grinding noise. • Lack of movement in rod.	• Slippery behaviour	• Wear in the gear	• Proper lubrication • Good steering geometry
		Steering Shaft	• Loosening of the rod • Torsional failure	• Breakage of shaft • free play	• improper inclination of the shaft • bearing failure	• Strong material should be used • proper and effective design
		Universal Joint	• Weird noise	• Vehicle breaks down and stops moving	• Misallignment of drive shaft • Out of balance Load	• Good lubrication • Proper allignment of drive shaft
		Tie rod	• Wear and tear	• Excessive play in steering wheel	• Insufficient lubrication	• Good quality material should be used • Proper lubrication
		Ball joint	• Damage due to bumpy road conditions	• Clunking noise • Drifting steering	• Impurities like dirt gets inside the joints • Rusting due to lack of lubrication	• Proper lubrication
7	**Battery**	Tractive battery	• Heat • Vibration • High self discharge	• Balancing issues • Battery ages	• Lack of Maintenance •High Temperature increases the self discharge	• Maintaining the battery at low temperature using cooling fan. • Battery to be mounted in a proper way to avoid vibration
		SLI Battery	• Temperature	•Self discharging	•Overcharging	
		Battery Cover	•Collision	• It cannot act as a shield against electromagnetic radiation and protect the penetration of liquids	• Vibration	• Control the collision

		BMS	• Overcharging • Discharging	• Overheating • Battery Aging	• When the BMS is defective it cannot monitor the Overcharging & Discharging	• Proper Maintenance of the BMS • Make sure the product purchased is in good condition
8	**Solar Plates**	Solar Panel	• Delamination • Discoloring of the laminate •Humidity freeze	• Cracks • Hot spots lead to fire dust residue	• Hot spots speed up the degradation of solar cells • Micro cracks on solar panels	• Proper Lamination • Make sure that there are no poorly soldered joints and cracks on solar cells.
		Charge controller	•Unable to charge •Charging current is too small	• Battery will be overcharged or discharged	•Terminals are not connected correctly • Wrong wiring	•To check whether the terminals of the solar panels are connected correctly
9	**Motor Controller**	BLDC motor controller	•Breakage	• The functioning of the battery & the motor degrades	• When the voltage is overrated, the controller may break	• By choosing the proper load it can be rectified
10	**BLDC Motor**	Chain	•Breakage of chain	• The Vehicle becomes stationary	• Overload place stress on the chain • Improper Lubrication	• Lubricate properly •Place the proper load accordingly
		Sprocket	•Electrical Overload •Excess oiling	•Misalignment of loads	•excess chain slack •Foreign material stuck to the bases of sprocket teeth	•Replace the sprocket •Adjust the amount of slack
		Cooling Fan	•Lubricant degradation	• Fan does not rotate properly	•Improper Lubrication	•To Maintain a proper Lubrication
		Roller bearings	•Rusting •Corroding •Skewing	•Increased downtime	• Overload, fatigue, rust and high speeds combined with small sprockets are the main reasons roller chains fail	•Lubricate bearings properly •Additional diagonostic tests
11	**Circuiting**	Wires	• Mechanical stress •Accumulation of dirt	• Wires might get damaged which leads to open circuit	• Changes in Temperature •Improper cleaning	•To consider the length of the wire to be slightly more than needed. •To seal the wires inside the flexible hoses for mechanical protection •Make sure the surrounding of the wires are dirt free.
		Connectors	•Contact Resistance •Insulation breakdown	•Difficult for the current to flow through	• High Humidity	•Check for any damages,quick spray of the electrical contact cleaner
		Motor driver	• Heat • Temperature tolerance	• Insulation breakdown • Any voltage imbalance will lead to an even higher current unbalance. • Bearing failure	• Overheating • Running in reverse • Shaft misalignment • Locked rotor	• Kept motor as cool as possible • Eliminate contamination entering the motor by cleaning • Motors should be checked regularly for vibration, using a motor analysing tool

		fuse	• Metal ribbon inside the fuse melts • Fusible body	• Cause wiring to overheat • Melting the insulation • Could cause a fire.	• Defective switches and faulty wiring • Multiple outlet adapter plugged into a socket • Too many plug-in appliances at once	• Unplugging it and replace the circuit fuse
		Brake lights	• Wire damage • Burnout of bulbs	• Bulbs are burned out	• Blown fuse • Wiring switch broken	• Replace bulb • Check wire connection