1.3.2. Name of the Course that include experiential learning through project work/fieldwork/internship:

S.No	Name of the Course that include experiential learning through project work/field work/internship	Course code	Page No
1	Engineering Mechanics	GE8292	2
2	Kinematics of Machinery	ME8492	6
3	Manufacturing Technology – II	ME8451	11
4	Thermal Engineering- II	ME8595	16
5	Design of Machine Elements	ME8593	21
6	Design of Transmission Systems	ME8651	26
7	Automobile Engineering	ME8091	31
8	Hydraulics and Pneumatics	ME8694	36
9	Mechatronics	ME8791	41
10	Robotics	ME8099	47

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GE8292	ENGINEERING MECHANICS	L T P C
		3 2 0 4

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES 9+6

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 9+6

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9+6

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9+6

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 9+6

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

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DESIGN AND FABRICATION OF AUTOMATED RAIN GUTTER SYSTEM

A PROJECT REPORT

Submitted by

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C.MOORTHI RAJA	**(712819114309)**
A.PACKIA YOOGARAJ	**(712819114712)**

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

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MAY 2023

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Submitted for Anna University examination held on.....22.5.23.....

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Over the years of the rising population, practices that increase demand for water supply and electricity have grown in industries as well as in the expansion of agriculture.

Monsoon is still the main hope and the source of our agriculture. In this perception, water-saving has become a necessity for mankind.

Rainwater harvesting is a way to capture rainwater at the time of the downpour, store the water above the ground or download the underground water and use it later. Presently, rainwater harvesting is being carried out by the method of using the pathway at rooftops.

But, the accumulation of dry leaves and microbial contamination in the rainwater pathway blocks the outlet and degrades the quality of water. The above mentioned problem will be addressed in the present investigation, which aims to design an automated rainwater pathway, thereby enabling the collection of pure water.

This system will make use of a mechanism that will be actuated by a rain gutter which is actuated by a motor, controlled by a rain sensor.

CHAPTER-X

CONCLUSION

By the realization of the present work which aims to save water and replenish the underground freshwater, we will be able to accomplish saving water up to a huge extent for drinking and other domestic purpose and for future needs.

The demand for water will be crucial in coming years and policies for implementing rainwater harvesters in every house will be mandatory. Their function becomes increasingly more important and challenging once they begin to be used for collecting water to be used for drinking.

This project will help in the accomplishment of the aforementioned objective and in socioeconomic development.

The project carried out by us made an impressing task in the field of home and industrial. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided.

ME8492	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement,velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkagemechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and theeffects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS **9**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility - Kutzbach criterion, Gruebler's criterion - Grashof's Law - Kinematic inversionsof four-bar chain and slider crank chains - Limit positions - Mechanical advantage - Transmission Angle - Description of some common mechanisms - Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS **9**

Displacement, velocity and acceleration analysis of simple mechanisms - Graphical method- Velocity and acceleration polygons - Velocity analysis using instantaneous centres - kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS **9**

Classification of cams and followers - Terminology and definitions - Displacement diagrams - Uniform velocity, parabolic, simple harmonic and cycloidal motions - Derivatives of follower motions - Layout of plate cam profiles - Specified contour cams - Circular arc and tangent cams -Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS **9**

Law of toothed gearing - Involutes and cycloidal tooth profiles -Spur Gear terminology and definitions -Gear tooth action - contact ratio - Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains - Speed ratio, train value - Parallel axisgear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS **9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication - Friction clutches - Belt and rope drives - Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the basics of mechanism
CO2 Calculate velocity and acceleration in simple mechanisms
CO3 Develop CAM profiles
CO4 Solve problems on gears and gear trains
CO5 Examine friction in machine elements

TEXT BOOKS:

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4 Edition, Oxford University Press, 2014.

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FABRICATION OF KINETIC ENERGY RECOVERY SYSTEM FOR BICYCLE

A PROJECT REPORT

Submitted by

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YADAV.M	**(712819114307)**
NAVANEETHAN.K	**(712819114701)**

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22/5/23

INTERNAL EXAMINER

22/5/23

EXTERNAL EXAMINER

ABSTRACT

Kinetic Energy Recovery System, commonly abbreviated KERS, is a system to recover the Kinetic energy of a moving vehicle under braking. This system stores the kinetic energy in the form of potential energy and converts it back to kinetic energy when needed. When riding a bicycle I become too tiresome to start the bicycle again after braking. If the bicycle is provided with a kinetic energy recovery system then the rider will have two power sources that he can use at his will. When brakes are applied kinetic energy is wasted because the kinetic energy converts into heat energy due to friction at the contact surface and the heat energy dissipates into the atmosphere due to thermal radiation. Vehicles equipped with KERS devices are able to take some of its kinetic energy out slowing down the vehicle. This is a form of braking in which energy is not wasted, instead gets stored in some device. Using a proper mechanism, this energy that is stored in terms of potential energy can be converted back into kinetic energy to give the vehicle an extra boost of power. In the literature review different types of available KERS systems are compared and a mechanical based KERS System is found to be the best suitable for a bicycle. Mechanical KERS system there are of two types, one is a clutch based and another is a CVT based K.E. recovery system. In this project a hybrid of the about two type of KERS systems is designed. Instead of CVT a variable sprocket ratio is used to make the power transmission smoother. Finally the complete manufacturing process of this KERS system is explain elaborately so that any researcher can follow those steps and design a KERS system for his/her bicycle.

CHAPTER:11

CONCLUSION:

In this project a flywheel based KERS system was designed. The product designed in this project is a hybrid of clutch and CVT based KERS systems. This system is expected to be cheaper than CVT based KERS system. Effective and efficient manufacturing procedures for the components ofthe KERS were also found out. Using FEA analysis the components are tested and modified to avoid failure. This project can guide anyone to fabricate his own KERS system for his bicycle veryeasily. It was found that all the components were safe under the extreme operating condition. Different types of KERS systems and their uses were also studied. It was found that flywheel can be used instead of battery to store and deliver energy efficiently. As use of flywheel in bicycle is anew concept, this field has a huge scope and wide range of implementation ahead.

ME8451	MANUFACTURING TECHNOLOGY – II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools- nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling ,reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes -finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process- cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

Numerical Control (NC) machine tools - CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the mechanism of material removal processes.
CO2 Describe the constructional and operational features of centre lathe and other special purpose lathes.
CO3 Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
CO4 Explain the types of grinding and other super finishing processes apart from gear manufacturing processes.
CO5 Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.

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DESIGN AND FABRICATION OF PNEUMATIC LIFTER

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"DESIGN AND FABRICATION OF PNEUMATIC LIFTER"** is the bonafide work of

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

- This project is developed for the users to lift any weight using air pressure. High pressure air is stored in a tank. A cylinder with piston arrangement is connected with a zig-zag pattern. Two pipes connected with ball valves connect the air tank with the cylinder. When one valve is opened, the air rushes out into the cylinder. Therefore, the piston moves in one direction.

- The rod connected with the piston pushes the zig-zag frame so that the lift moves up. When the other ball valve is opened, the air inside the cylinder is released. Therefore, the lift comes down.

- The Pneumatic lifter is a mechanism to lift blocks, bricks, cotton bale, wood log and some over weighted objects with the help and power of pneumatic cylinder.

- With the help of pneumatics, the fork mounted in front can move up and downwards to lift the object, after lifting the weight the object can be transported from working place to stacking place or to load and unload the object.

CHAPTER 6

6. CONCLUSION

We were able to successfully complete the design and fabrication of pneumatic lifter. By doing this project we gained knowledge about pneumatic system and uses of compressed air. We also learned how toweld structures properly and orderly and effectively.And the working principles and seals, o-rings about pneumatic system.

ME8595	THERMAL ENGINEERING – II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

UNIT I STEAM NOZZLE **9**

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS **9**

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

UNIT III STEAM TURBINES **9**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY **9**

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

UNIT V REFRIGERATION AND AIR – CONDITIONING **9**

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Solve problems in Steam Nozzle

CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.

CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.

CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers

CO5 Solve problems using refrigerant table / charts and psychrometric charts

TEXT BOOKS:

1. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V.,"A course in Thermal Engineering", Dhanpat Rai & Sons, 2016.
2. Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata Mc Graw Hill Publications, 2010.

REFERENCES:

1. Arora .C.P., "Refrigeration and Air Conditioning", Tata Mc Graw Hill, 2008
2. Ballaney. P.L ." Thermal Engineering", Khanna publishers, 24th Edition 2012
3. Charles H Butler : Cogeneration" McGraw Hill, 1984.
4. Donald Q. Kern, " Process Heat Transfer", Tata Mc Graw Hill, 2001.
5. Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand Reinhols,1985

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SOLAR AIR COOLER WITH HEATER

A PROJECT REPORT

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Viva voice held on .....

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Solar Air cooling is Comfort cooling system for human by using non-conventional energy. This project would be fruitful in both domestic & industrial backgrounds. Solar air conditioning does not use any Freon or other hazardous chemicals. Solar energy may be the best way to obtain replenishes able power.

Mechanical Engineering without production and manufacturing is meaningless and inseparable. Production and manufacturing process deals with conversion of raw materials inputs to finished products as per required dimensions, specification and efficiently using recent technology. The new developments and requirements inspired us to think of new improvements in air conditioning Engineering field. Nowadays heater as well as cooler is available in market separately. Hence, we decided to take over both applications in a same system. It's a new step ahead in air conditioning Engineering field.

The objective of this project is to find necessities enlivened us to consider new changes in cooling system by using nonconventional energy. Sun oriented power is the innovation of changing over daylight specifically into power. It depends on photograph voltaic or sun-oriented modules. Abundant source of Sunlight is useful in reducing the cost of electric power in Solar Air cooler. Solar air conditioning has great potential.

Our project fulfilled all our requirements as our thoughts. Heater can be used in winter and cooler in summer. Hence it is a multipurpose project. Our project is vital one to the environment. In our project, solar power is stored in a battery. This power is used to run the air cooler whenever we required. The heating coil works with a D.C supply which is drawn supply from battery. Solar energy means all the energy that reaches the earth from the sun. It provides

CHAPTER – XII

CONCLUSION

By completing this project, we have achieved a clear knowledge of comfort cooling system for human by using non-conventional energy and heating system by power supply. This project would be fruitful in both domestic & industrial backgrounds.

We also know about non-conventional energy sources and utilization.

SCOPE OF IMPROVEMENT:

This project although fulfilling our requirement has further scope for improvements. Some of the improvements that could be made in this solar air cooler unit are listed below.

- By adding solar panel auto tracking system
- By adding some components to make solar heater cum cooler

ME8593	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the influence of steady and variable stresses in machine component design.
CO2 Apply the concepts of design to shafts, keys and couplings.
CO3 Apply the concepts of design to temporary and permanent joints.
CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

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DESIGN AND FABRICATION OF INTELLIGENT BRAKING SYSTEM

A PROJECT REPORT

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Submitted for the university project examination held on 22-05-2023

22/5/23

INTERNAL EXAMINER

22/5/23

EXTERNAL EXAMINER

ABSTRACT

The aim is to design and develop a control system based on intelligent electromagnetically controlled braking system is called INTELLIGENT BRAKING SYSTEM. This Braking system is consisting of ultrasonic sensor unit, Electromagnetic braking system. The Ultrasonic sensor is used to detect the obstacle distance in LCD display. The obstacle closer to the vehicle the control signal is given to the braking system. The Electromagnetic braking system is used to break the vehicle.

In our project of ULTRASONIC DISTANCE METER is suitable for measuring distances 50cm. The measured distance is shown on a 3-digit liquid crystal display (LCD).

This project aims to create an electromagnetic braking system model capable of applying brakes without any friction loss and without losing the energy supplied. It uses electromagnets which runs by the supply of power from the circuit. Also, there is a wheel which is attached to the motor so when the power the supplied, by the help of motor the wheel rotates. Then a fan is attached near electromagnets to cool the electromagnets from excessive heating.

A metal bar is in the vicinity of the electromagnets and wheel so when the electromagnets produce eddy currents which stops the rotating wheel or rotor. This model helps in a way to be a used a retardation equipment in vehicle.

CHAPTER -12

CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

Intelligent braking system represents a significant advancement in automotive safety technology, and has the potential to protect vehicles and prevent serious damages. As the technology becomes more widespread, it is likely that we will see continued improvements in vehicle safety, and a reduced number of accidents on the road.

We are proud that we have completed the work with the limited time successfully. The **INTELLIGENT ELECTROMAGNETIC BRAKE** is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus, we have developed an **"INTELLIGENT BRAKING SYSTEM"** which helps to know how to achieve low-cost automation. The application of pneumatics produces smooth operation. By using more techniques, they can be modified and developed according to the applications.

ME8651	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanicalelements
- To learn to use standard data and catalogues(Use of P S G Design Data Book permitted)

UNIT I DESIGN OF FLEXIBLE ELEMENTS **9**

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS **9**

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS **9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES **9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES **9**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches -axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 apply the concepts of design to belts, chains and rope drives.
CO2 apply the concepts of design to spur, helical gears.
CO3 apply the concepts of design to worm and bevel gears.
CO4 apply the concepts of design to gear boxes .
CO5 apply the concepts of design to cams, brakes and clutches

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DESIGN AND FABRICATION OF ECO FRIENDLY BICYCLE

A PROJECT REPORT

Submitted by

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MUNIYASAMY M	**(712819114703)**
SURIYAPRAKASH R	**(712819114705)**

In partial fulfilment for the award of the degree
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IN

MECHANICAL ENGINEERING

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MAY 2023

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Viva voice held on 22/5/23

22/5/23

INTERNAL EXAMINER

22/5/23

EXTERNAL EXAMINER

ABSTRACT

There are so many vehicles that came to influence in the existing world. Their operating systems are based on usual fossil fuel system. At the present sense the fossil fuel can exceed only for a certain period after that we have to go for a change to other methods. Thus, we have made an attempt to design and fabricate an ultimate system (Self charging electric bicycle) which would produce cheaper & effective result than the existing system. This will be very useful to the future needs of the world.

An attempt is made in the fabrication of a solar powered System for a two-wheeler (Cycle). This works on electric power distributed by the DC electric motor receiving the current from a battery. The motor and the various parts are such as sprocket, chain assembly, cycle and with easily available materials to serve and fulfill the purpose of the project. Battery is charged by using solar panel.

The drive system of the normal Cycle is not altered. This system is two in one system. The cycle is operated ether by

1. Pedaling manually
2. Battery and motor driving mechanism.

CHAPTER-12

CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

ME8091	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY EOURCES 9

Useof Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1	recognize the various parts of the automobile and their functions and materials.
CO2	discuss the engine auxiliary systems and engine emission control.
CO3	distinguish the working of different types of transmission systems.
CO4	explain the Steering, Brakes and Suspension Systems.
CO5	predict possible alternate sources of energy for IC Engines.

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TEXT BOOKS:

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

EXPERIMENTAL INVESTIGATION AND IMPLEMENTATION OF COMPRESSED AIR POWERED MOTORBIKE

A PROJECT REPORT

Submitted by

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IN

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COIMBATORE

ANNA UNIVERSITY : CHENNAI 600 025

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Currently, pollution is a factor that needs to be taken into account in the interest of protecting the environment. The exhaust gases from vehicles are the main cause of pollution.

Life in the twenty-first century is very fast and many times knowingly or unknowingly we pollute our environment by using non-renewable energy resources in vehicles. We are excessively dependent on non-renewable energy resources we need to search possible chances in the alternative of fossil fuels in vehicles.

This has sparked our interest in this area of creating an environment free from pollution. The pressurized air cylinder might work well in place of the standard combustion engine.

Compressed air cylinder motorcycles might significantly cut carbon emissions, especially in areas where motorcycles are largely utilized for public transportation. An air compressor is used as the source of drive.

A bike running with compressed air as fuel is Air powered bike. It is a motorcycle which uses the compressed air as its power source so that it will be truly free of pollution for the environment.

Experimental analysis were carried out on this modified engine to find out its performance characteristics like brake power, mechanical efficiency, overall efficiency, air to Air ratio, volumetric efficiency, cost analysis etc.

CHAPTER 7

CONCLUSION

We were able to successfully complete the design and fabrication of air engine. By doing this project we gained knowledge about pneumatic system and working of IC engines using compressed air. We also learned how automation can be effectively done with the help of pneumatic system.

The air driven engine provides effective method for power production and transmission even though its application are limited currently, further research could provide wider applications.

The air bike which we made can be used for handicapped people. The design is actually made for them. Due to only presence of one cyclinder there won't be over speeding the speed limit is 25km/hr

Currently the number of people who can travel on it is one. If the chassis and power of engine get changed then the number of people can increase

Advantages:

- Less costly and more effective
- The air engine is an emission-free piston engine that uses compressed air as a source of energy
- Simple in construction. The engine can be massively reduced in size
- Easy to maintain and repair
- Low manufacture and maintenance costs

ME8694	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modernindustrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation offluid power circuits.

UNIT I FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power - Advantages and Applications - Fluid power systems - Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss - Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary - Fixed and Variable displacement pumps -Problems.

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

Hydraulic Actuators: Cylinders - Types and construction, Application, Hydraulic cushioning - Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves - Types, Construction and Operation - Servo and Proportional valves - Applications - Accessories : Reservoirs, Pressure Switches - Applications - Fluid Power ANSI Symbols - Problems.

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits - Regenerative, Pump Unloading, Double- Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servosystems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

Properties of air - Perfect Gas Laws - Compressor - Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit - Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL:45 PERIODS

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DESIGN AND FABRICATION OF EXPANDABLE CHASSIS IN LORRY USING HYDRAULIC SYSTEM

A PROJECT REPORT

Submitted by

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MANOJ PANDIAN C	**(712819114302)**
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IN

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MAY 2023

BONAFIDE CERTIFICATE

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Viva voice held on 22.05.2023

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Chassis is one of the important part of the any automobile. It plays crucial role in the heavy load carrying capacity vehicles like containers. It acts as a back bone of the vehicle. The chassis supports the engine, cabin and suspension system of the vehicle. The main function is to carry the maximum load for any designed condition. The chassis is nearly designed for a load of 10 to15 tons. Under this load it may be subjected to shocks, impact loads due to uneven roads. It also absorbs drive line torque endure torque load on uneven road surfaces. The chassis contains cross members of different cross sections. The chassis is of a ladder shape.

The aim is to design the truck by changing the length by using hydraulic system. Instead of procuring larger length, we can expand it by using hydraulic system. So we do not need the large trucks for this operation. Hydraulics is a mechanical function that operates through the force of liquid pressure. In hydraulics based systems, mechanical movement is produced by contained, pumped liquid, typically through hydraulic cylinders moving pistons.

CHAPTER X

CONCLUSION

A method for performing design oriented calculations investigating the three load cases, Lateral Loading, Frame Torsion and Vertical Load on Kingpin have developed.

• Three load cases have been established in the Generative Assembly Structural analysis module of Catia (GAS). The setup of the model is by a large margin the most time consuming part of the process.

• The load cases have been verified by comparisons to Abacus references. The difference in deformation and stress levels between the Cation model and Abacus reference are varying depending on the load case. The Lateral Loading case shows less sensitivity to the differences in suspension stiffness compared to the Frame Torsion case.

• The impact from differences in calculation software have been considered and highlighted. The effect on the global deformation of the Abacus reference due to Geometrical literariness is negligible. The effect due to contact

nonentities is considerable.

• The analysis setup time have been made considerably shorter by use of script based on automation. This approach to analysis setup is a potent time saving possibility. Implementing fully automated analysis setup is conceivable.

• A method of utilizing sub modeling for reducing the computation time has complemented. The method allows for importing deformations from other FEM

ME8791	MECHATRONICS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge about the elements and techniques involved in Mechatronics systemswhich are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION **9**

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics - Emerging areas of Mechatronics - Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers - LVDT - Capacitance sensors - Strain gauges - Eddy current sensor - Hall effect sensor - Temperature sensors - Lightsensors

UNIT II MICROPROCESSOR AND MICROCONTROLLER **9**

Introduction - Architecture of 8085 - Pin Configuration - Addressing Modes -Instruction set, Timingdiagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE **9**

Introduction - Architecture of 8255, Keyboard interfacing, LED display -interfacing, ADC and DAC interface, Temperature Control - Stepper Motor Control - Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER **9**

Introduction - Basic structure - Input and output processing - Programming - Mnemonics - Timers,counters and internal relays - Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN **9**

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process - Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Engine Management system – Automatic car park barrier.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2 Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.

CO3 Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device interfacing

CO4 Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.

CO5 Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

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TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall, 2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the8085”, 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
3. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishingcompany, 2007.
4. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.
5. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurementsystems”, McGraw Hill International edition, 2007.

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IOT BASED SMART AGRIGULTRE AND AUTOMATIC SEED SOWING ROBOT

A PROJECT REPORT

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MAY 2023

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Viva voice held on 22.05.2023

22/5/23

INTERNAL EXAMINER

22/5/23

EXTERNAL EXAMINER

ABSTRACT

In today's era all sectors are moving towards the rapid growth using many advanced technologies. Of all these sectors, agriculture is also one of them. In order to meet the increasing demand of food, farmers have to implement advanced techniques so that the soil texture is not affected and the overall food production is increased. Hence, in this project we aim at designing and fabricating a solar operated seed sprayer machine. Seed sowing process is usually carried out by humans using manual power. In this solar seed sprayer machine project, seed in a hopper gets sprayed by means of fan or blower directly to the land without any manual effort. Using this process, the seeds are fed in the land during the time of plough. The main advantage of using this technique is that, it reduces the time of seed to land and reduces human efforts. In this solar agriculture sprayer solar panel is used as power source which is used to run the fan, and thus does not require any additional power supply. This innovative mechanical project of seed sowing equipment can save more time for sowing process and also it reduces a lot of labor cost. This solar agro sprayer project is very helpful for small scale farmers. The Internet of Things (IoT) describes the network of physical objects "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

CHAPTER-10

CONCLUSION

The project carried out by us made an impressing task in the field of agricultural sector. The multi utility agricultural machine is very usefully for the workers to carry out a number of operations in a single machine. Practically our multi utility agricultural machine can be used for seed sowing, ploughing. All the parts are arranged in such a way that in every stage of agriculture, the equipment can be rearranged to perform the specified action. Our team has successfully combined many ideas from various fields of mechanical engineering and agricultural knowledge to improve the yield and by reducing the labour effort and expenses. The whole idea about multipurpose equipment is a new concept, patentable and can be successfully implemented in real life situations. More operations can be included to the vehicle like soil leveler, grass cutter and many other machines for various operations. Also engine can be used to drive the equipment which will reduce the work load. The tyre can be changed according to the type of the land. The plough tool tip arrangement is made separately, so in case of breakage the tip of the tool is alone changed. A steering mechanism can also be done for the ease of control.

ME8099	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT **9**

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **9**

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **9**

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **9**

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.

CO2 Illustrate the different types of robot drive systems as well as robot end effectors.

CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.

CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.

CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

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TEXT BOOKS:

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OPTIMIZATION WITH TAGUCHI BASED S/N RATIOS METHOD OF CNC TURNING PROCESS PARAMETERS ON HCHCr STEEL FOR SURFACE ROUGHNESS AND MRR

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"OPTIMIZATION WITH TAGUCHI BASED S/N RATIOS METHOD OF CNC TURNING PROCESS PARAMETERS ON HCHCr STEEL FOR SURFACE ROUGHNESS AND MRR"** is the bonafide work of **"GOKULAKRISHNAN R (712819114012), KIRUBHAHARAN M P (712819114016), NAVANEETHAN N (712819114018), SRIDHARAN M (712819114023)"** Who carried out the project work under my supervision.

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Abstract

The current investigation is, to determine the optimum process variables on CNC turning operation of High Carbon High Chromium Die steel (HCHCr) using Taguchi based S/N ratio method. In this Taguchi, optimum level of turning variables can be identified by the larger the better option with ANOVA as the performance index. In present work, the three turning variables were chosen namely cutting speed (V1 = 1500 rpm, V2 = 2000 rpm and V3 = 2500 rpm), feed rate (F1 = 0.3 mm/rev, F2 = 0.6 mm/rev and F3 = 0.9 mm/rev) and depth of cut (D1 = 0.10 mm, D2 = 0.15 mm and D3 = 0.20 mm) and the output responses such as material removal rate (MRR) and surface roughness (SR) were considered. Taguchi S/N ratio was used to identify the optimum turning process variables on multi response characteristics with an objective to maximize the MRR and minimize the SR. Based on the Taguchi method, optimum level of turning variables was identified as V3F3D2 that is cutting speed at level 3 (2500 rpm), feed rate at level 3 (0.3 mm/rev) and depth of cut at level 2 (0.15 mm). The significant effect of each variable on response was determined by analysis of variance (ANOVA). From ANOVA result shows that DOC was the most significant factor on multi response characteristics followed by cutting speed and feed rate. Finally, the verification test was performed to validate the experimental results.

Keywords: HCHCr, Feed, Speed, DOC, Taguchi

CHAPTER-6

CONCLUSIONS

1. Taguchi method of experimental design has been applied for optimizing multi-response process parameters for CNC turning of HCHCr by using L9 orthogonal array.
2. Results obtained from Taguchi method exactly matches with ANNOVA.
3. From Measured Response Table, Feed rate is the most influencing parameter for minimum surface finish which is followed by depth of cut and cutting speed.
4. From Measured Response Table, best parameters found for minimum surface finish machining are feed rate= 0.3mm/min, cutting speed = 2500rpm and depth of cut= 0.15mm/rev.
5. The parameters found for rough machining are feed rate= 0.9mm/min, cutting speed = 1500rpm and depth of cut= 0.2mm/rev.
6. From Measured Response Table Depth of cut is the most influencing parameter for material removal rate which is followed by feed and cutting speed.
7. From Measured Response Table, best parameters found for minimum surface finish machining are feed rate= 0.3mm/min, cutting speed = 2500rpm and depth of cut= 0.15mm/rev.
8. The parameters found for rough machining are feed rate= 0.9mm/min, cutting speed = 1500rpm and depth of cut= 0.2mm/rev.