Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
Phone : 07104 – 236381, 237307, Fax : 07104 – 237681,
email : principal.pce.ngp@gmail.com, www.pcenagpur.edu.in

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

2016-17

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

B.E – MECHANICAL ENGINEERING M-TECH-MECHANICAL ENGINEERING DESIGN

Sr.	Name of the course that include experiential learning through Project work/ Internship	Subject Cod	Domain	Page No
1	Kinematics Of Machines	BEME302T	**Design**	**29,**
2	Machine Drawing	BEME306P		**25,**
3	Design of Machine Elements	BEME502T		**9,**
4	Computer Aided Design	BEME703T/P		**17,**
5	Design of Mechanical Drives	BEME705T/P		**4**
6	Mechanics Of Material	BEME405T/P		
7	Dynamics of Machines	BEME605T/P		
8	Elective – I: Tool Design	BEME702T2		
9	Elective – I: Advance I.C. Engines	BEME803T5		
10	Elective – I: Synthesis of Mechanisms	BEME702T5		
11	Dynamics of Machinery	PGMED102T		
12	Advanced Mechanical Drives	PGMED201T		
13	Design of Mechanical Handling System	PGMED203T		
14	Elective III-Tribology And Bearing Design	PGMED204T		
15	Finite Element Analysis	PGMED207P		
16	Elective IV-Finite Element Analysis	PGMED301T		
17	Elective IV-Optimization in Engg. Design	PGMED301T		

18	Stress Analysis	PGMED202T/P		
19	Mechanical Vibrations	PGMED103T/P		
20	Advanced Mechanisms	PGMED101T/P		
21	Manufacturing Process	BEME304T/P	**Production**	**37**
22	Machining Processes	BEME404T/P		
23	Advanced Production Processes	BEME503T		
24	Automation in Production	BEME804T/P		
25	Industrial Engineering	BEME701T		
26	Industrial Economics & Entrepreneurship Development	BEME501T		
27	Industrial Management	BEME801T		
28	Engineering Metallurgy	BEME305T/P		
29	Mechanical Measurement & Metrology	BEME505T/P		
30	Operations Research	BEME603T		
31	Elective – I: Industrial Robotics	BEME702T1		
32	Engineering Thermodynamics	BEME402T	**Thermodynamics**	**33, 13, 21**
33	Fluid Mechanics	BEME303T		
34	Hydraulics Machines	BEME403T/P		
35	Heat Transfer	BEME504T/P		
36	Energy Conversion- I	BEME601T		
37	Energy Conversion - II	BEME704T/P		

38	Energy Conversion - III	BEME805T/P		
39	Elective – I: Power Plant Engineering	BEME702T4		
40	Elective – II: Industrial Fluid Power	BEME802T3/ P3		
41	Elective – III: Renewable Energy Systems	BEME803T3		
42	Elective III-Design of Hydraulic And Pneumatic System	PGMED204T		
43	Industrial Visit	BEME507P	**Other**	
44	Industrial Case Study	BEME608P		
45	Mini Project	BEME407P		
46	Project Seminar	BEME706		
47	Project Seminar	PGMED303P		
48	Project	BEME806P		
49	Project	PGMED401P		
50	Control Systems Engineering	BEME602T		
51	Computer Applications – I	BEME506T		
52	Mechatronics	BEME604T/P		
53	Functional English	BEME606T		
54	Computer Applications – II	BEME607P		
55	Technical Report and Seminar	BEME307P		
56	Environmental Studies	BEME406T		

BEME802T1: ELECTIVE-II: FINITE ELEMENT METHOD (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues as well as providing hands on experience using finite element software for modeling & analyzing stresses, strains, deformations, natural frequencies, modal shapes etc. for machine/structural components.

UNIT – I: Introduction **[12 Hrs.]**

Theoretical background - Brief History of FEM, General FEM procedure, Applications of FEM in various fields, Advantages and disadvantages of FEM.

Review of Matrix Algebra - Determinants, Matrices, Bandwidth, Inverse of a Matrix, Eigen values, Solutions of simultaneous equations – banded skyline solutions.

Review of Solid Mechanics – Stress equilibrium equations, Strain-Displacement equations, Stress-Strain-Temperature Relations, Plane stress, plane strain and axisymmetric problems, Strain energy, Total potential energy, Essential and natural boundary conditions

Governing differential equations, Variational and Weighted Residual methods, weak formulation.

Finite element modeling - Node, Element, different types of element – spring, bar, truss, beam, frame, plane stress/strain (CST element) and axi-symmetric elements, Coordinate systems – global, local and natural coordinate systems, Order of element, internal and external node(s), Degrees of freedom, primary and secondary variables, shape functions – linear, quadratic and cubic, properties of shape functions. Assembly of global stiffness matrix and load vector, Properties of stiffness matrix, half bandwidth, Numbering system to reduce bandwidth, Boundary conditions – elimination method and penalty approach, Symmetric boundary conditions, Calculation of elemental stiffness matrix and load vector (mechanical and thermal load) using energy method Stress calculations. FE Problems on Solid mechanics 1D bar element, composite element, Thermal stress, Torsion of Circular shaft.

UNIT – II: FEM for Plane Truss, Beam and Frames **[12 Hrs.]**

Introduction, Plane truss formulation of stiffness matrix for truss, problem on truss, temperature stress, Introduction to space truss, formulation of stiffness matrix for space truss.

FEM for Beams and plane frame – Introduction, element formulation, load vector, boundary conditions, shear force and bending moment, Beam on elastic support, Plane frame analysis, problem on beams, problem simple plane frame (max. 2 elements/member).

UNIT – III: Multipoint Constraints 1D Element, 2D CST Element and Isoparametric Elements and Formulations **[12 Hrs.]**

Problems on Multipoint constraint 1D element.

CST ELEMENT - Coordinate mapping Natural coordinates, Area coordinates (for triangular elements), Formulation of stiffness matrix, load vector. Quadrilateral element.

ISOPARAMETRIC ELEMENTS - Isoparametric formulation, coordinate transformation , super parametric and subparametric. Convergence requirements – patch test, Uniqueness of mapping - Jacobian matrix. Formulation of element equations (stiffness matrix and load vector). Numerical integration.

FE Discretisation - Higher order elements vs. refined mesh (p vs h refinements).

UNIT – IV: Steady State Heat Transfer, Dynamic Consideration and Computer Implementation of Finite Element Method [12 Hrs.]

Steady State Heat Transfer Problems - Introduction, steady state heat transfer – 1D and 2D heat conduction and convection Governing differential equation, boundary conditions, formulation of element.

Dynamic Considerations (Undamped Free Vibration) - General dynamic equation of motion, Formulation for point mass and distributed masses – Consistent and lumped element mass matrices for bar element, truss element, beam element, CST element, axisymmetric triangular element and quadrilateral element.

Generalized eigen value problem, Evaluation of eigen values and eigenvectors, Applications to bars, stepped bars and beams for axial, transverse and torsional loading.

Computer Implementation of the Finite Element Method - Pre processing: Model definition – Nodal coordinates, element connectivity, material and element type and property definitions, type of analysis (static/dynamic), loading and boundary conditions.

Meshing techniques - free and mapped meshing, Quality checks – aspect ratio, warp angle, skew, distortion, stretch, included angle, taper.

Processing: Element level calculations, Equation assembly, Equation solver (sparse solvers, factorization, numerical/computational issues).

Post Processing: Strain and stress recovery (integration and nodal points), interpretation of results (results validation and data interpretation) and design modification.

LIST OF TUTORIALS: (at least Six)

1) Matrix Inverse and solution of matrix by Elimination and Penalty methods.
2) A numerical using Variational Methods.
3) A numerical using Weighted Residual method.
4) Any two numerical using Galerkin and Rayleigh-Ritz method.
5) A numerical using Principle of Minimum Potential Energy method.
6) Derivation of Lagrange's shape functions for 1-D (Linear, Quadratic and Cubic) element.
7) Determinations of primary and secondary variables for bar.
8) Determinations of primary and secondary variables for truss.
9) One numerical on heat transfer.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A. D., Prentice Hall.
2. Finite Element Analysis, Bhavikatti S. S., New Age International Publishers.
3. Text book of Finite Element Analysis, Chanakasava Alavala, PHI Learning Private Ltd.
4. Finite Element Method with Application in Engineering, Y.M.Desai, T.I.Eldho, A.H. Shah, Pearson publication.
5. First Course in the Finite Element Method, Daryl Logan, Cengage Learning,
6. An Introduction to the Finite Element Method, J. N. Reddy, McGraw Hill.
7. The Finite Element Method in Engineering, S. S. Rao, Butterworth-Heinemann.
8. Text book of Finite Element Analysis, Seshu P., PHI Learning.

REFERENCE BOOKS:

1. Finite Element Procedures, Bathe K. J., Prentice-Hall of India.
2. Finite Element Analysis, Theory and Practice, Fagan M. J., Pearson Education Limited.
3. Finite Element Modeling for Stress Analysis, Cook R. D., John Wiley and Sons Inc.
4. Kwon Y. W., Bang H., Finite Element Method using MATLAB, CRC Press.
5. Finite Element Analysis, Theory and Application with Ansys, S. Moaveni, Pearson.
6. Fundamental Finite Element Analysis and Applications, Asghar Bhatti, John Wiley and Sons Inc.
7. Fundamental of Finite Element Analysis, David V. Hutton, Tata McGraw Hill Education Pvt. Ltd.
8. The Finite Element Method, Zienkiewicz O. C., Taylor R. I., Butterworth-Heinemann.
9. Finite Element Application, G. Lakshmi Narasaiah, BS Publications.
10. Practical Finite Element Analysis, Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N, Finite to Infinite, Pune.
11. Introduction to Finite Elements Method, Desai and Abel, CBS Publication.
12. Introduction to Finite Element Analysis Using MATLAB® and Abaqus, Amar Khennane, CRC press.

Department of Mechanical Engineering,
Priyadarshini College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bonafide record of project work entitled

An analysis to increase the productivity of Fuel Injection Pump shaft

carried out by

Pranav Sangole	Piyush Mishra
Oonkar Upalap	Tanmay Taunk
UmeshKumar Gautam	Subodh Tapase
Shashank Rathore	Sagar Fulewale
Parimal Lingayat	

Students of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Dr. A. A. Khan
Guide

Prof. P. M. Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K. S. Zakiuddin
Professor & Head of Department

Dr. M. P. Singh
Principal

Date:

Place

ABSTRACT

The current project addresses the analysis to increase the productivity oftheFuel Injection Pump Shaft.This study starts with understanding the standard operation procedures and analyzing the process flow to get the whole ideaonthe production of Fuel Injection Pump Shaft. At the same time, observations at the production line were made to identify the non-productive activities and problemsthat occurs during production.

These observations involves all the processes that had beentimed using the time study techniques. Thetime study analysis of the processes enablesthe reduction of non-productive time and tasks, resulting in a set standardized work procedures for the operations. The assessment for implementation of the potential and feasible solutions were taken into considerations to increase the productivity of the Fuel Injection Pump Shaft.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology
B.E. (MECHANICAL ENGINEERING): EIGHT SEMESTER

BEME803T5: ELECTIVE-III: ADVANCE INTERNAL COMBUSTION (IC) ENGINE (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes : This course is designed to understand the basic concept of I.C. engine and its components. It includes information of different engine operating cycles, engine lubrication, engine cooling, automobile fuel, fuel supply system, combustion in S.I. & C.I. engine, air pollution and its control. The course also involves performance and testing of I.C. engine. At the end of this course student will be able to understand the basic about I.C. engine, its components, working and recent advancement in I.C. engine.

UNIT – I: Engines types and their operation: **[8 Hrs.]**

Introduction, Engine classification, Engine components and material selection, Different Engine Operating cycles, Comparison of SI and CI engines, comparison of two stroke and four stroke engine, engine lubrication and cooling system. Engine losses- Frictional losses, blow by losses, pumping loss.

UNIT – II: Automotive fuels & Fuel injection: **[8 Hrs.]**

Air Fuel ratio requirement, Stoichiometric ratio (A/F), S.I. Engine fuels characteristics, C.I. Engine fuels characteristics, Rating of engine fuels, Availability – Suitability-merits- demerits and properties of Potential Alternative Fuels (Ethanol, Methanol, Hydrogen, LPG, CNG, Natural Gas, Bio gas and Bio-diesel). Fuel supply system- S.I. Engine introduction to Carburetors, Gasoline Injection – TBI, MPFI, GDI. Fuel supply system- C.I. Engine- Fuel injection pumps, Nozzles, D.I. systems and CRDI. Electronic control module (ECM) control functions. (Problems on simple carburettor and fuel injection system).

UNIT – III: Combustion in S.I. Engine: **[8 Hrs.]**

Charge motion within the cylinder, combustion stages, factors affecting combustion stages, abnormal combustion, combustion chambers- features and design considerations & types, ignition system- conventional- battery & magneto. Modern ignition system- electronic, CDI, supercharging & supercharging limits , scavenging in engines, ignition timing and spark advance .

UNIT – IV: Combustion in C. I. Engines: **[8 Hrs.]**

Charge motion within the cylinder swirl, squish, combustion stages in C. I. Engines, ignition delay, factors affecting delay. Effects of fuel properties. Abnormal combustion, combustion chambers- features and design considerations & types, supercharging & supercharging limits, turbo charging, Auxiliary apparatus- Glow plug. Comparison of abnormal combustion in S.I. & C.I. engine.

UNIT – V: Air pollution & control: **[8 Hrs.]**

Atmospheric pollution from Automotive engines, Global warming – Green house effect and effects of I.C. Engine pollution on environment. Pollutants from gasoline engines, causes of gasoline emission and its control , Diesel emission - Diesel smoke and its control, Exhaust-Gas recirculation (EGR), Positive crankcase ventilation (PCV) system, Evaporation emission control system. After

exhaust treatment system - Secondary air injection system, Catalytic converter, Euro Norms and Bharat stage Norms. Emission measurement equipment, Comparison of diesel and gasoline emission. Stratified charge engine, free piston engine, adiabatic engines & rotary engine.

UNIT – VI: Engine testing and performance parameters: **[8 Hrs.]**

Important engine characteristics of engines - Brake, Torque & Power, Mechanical efficiency, Road -load power, Mean effective pressure, Specific fuel consumption and efficiency, Volumetric efficiency, Specific emission and emission index, Relationship between performance parameters, Measurement and Testing - Measurement of friction power, indicated power, Brake power, Fuel consumption, Air consumption, Engine efficiencies. Variables affecting engine performance characteristics.

LIST OF TUTORIALS:

1) Introduction, I.C. Engine history & development.
2) Study of cooling and lubrication system of I.C. Engine.
3) Study of different types of alternative fuels.
4) Numerical on fuel supply system used in I.C. Engine.
5) Discussion on combustion in S.I. Engine.
6) Discussion on combustion in C.I. Engine.
7) Study of free piston engine, adiabatic engine and stratified charged engine.
8) Numerical on engine performance and testing.

TEXT BOOKS:

1. Internal Combustion Engines, V. Ganesan, Tata McGraw Hill.
2. Internal Combustion Engines, V. M. Domkundwar, Dhanpat Rai & Sons.
3. Internal Combustion Engines, M. C. Mathur, R.D. Sharma, Dhanpat Rai & Sons.
4. Fundamentals of Internal Combustion Engines, H.N. Gupta, PHI Learning.
5. Internal Combustion Engine, R.K. Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. Internal Combustion Engine Fundamentals, John B. Heywood, Tata McGraw Hill.
2. Internal Combustion Engines and Air pollution, Edward F. Obert, Intex Educational.
3. Automobile Engineering Vol.-2, Dr. Kirpal Singh, Standard Publishers.
4. Automobile Mechanics, Crouse & Anglin, Tata McGraw Hill.
5. I.C. Engine Combustion & Emission, Pundir B.P., Narosa publication.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bonafid.e record of project work entitled

AUTOMOTIVE FUEL ENHANCEMENT SYSTEM

carried out by

Shubham Pathrabe	Umang Patel	Pushkar Pandhe
Prasad Umalkar	Shubhankar Pawshe	Mehul Lal

of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Prof. V. M. Sonde	Prof. P. M. Sirsat	Dr. M. K. Sonpimple
Project Guide	Project Incharge	Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M. P. Singh
Principal

Date:

Place:

ABSTRACT

In this project we have studied the basic properties of gas generated through electrolysis of water and then used this gas in the a bike as a fuel with gasoline by mixing it with air. This results the increased mileage of bike 30 to 60% and reduce the polluting contents from the exhaust gases.The threat posed by climate change and the striving for securities of energy supply are issues high on the political agenda these days. Governments are putting strategic plan motion to decrease primary energy use, take carbon out of fuels and facilitate modal shifts. Taking a prominent place in these strategic plans is hydrogen as a future energy carrier. Energy stored in hydrogen would be available at any time and at any place on Earth, regardless of when or where the solar irradiance, the hydropower, or other renewable sources such as biomass, ocean energy or wind energy was converted.. Hydrogen gas combined with the standard air/fuel mixture increases the mileage. This form of alternative fuel is provided by a hydrogen generator mounted in the vehicle. Once set up is ready, the hydrogen gas (fuel) will be produced from water, an electrolyte compound, and electricity supplied from a battery provided. Here we are designing a mixed fuel device for two wheeler.ie in a conventional SI engine we are incorporating traces of hydrogen along with gasoline in order to minimum consumption of gasoline as well as to increase the power of vehicle. Here in addition, a hydrogen generating unit is made to produce hydrogen .It is actually an electrolysis unit having high grade stainless steel/graphite/semiconductors as electrodes in a closed container and mixture of distilled water & suitable ionic solution(KOH or NAOH) as electrolyte. Power for electrolysis is taken from an additional battery provided (12V).This battery can be recharged from a dynamo/alternator/motor provided on the vehicle. Keyword- KOH, NAOH, SI engine, electrolysis of water ,hydrogen cell.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): EIGHT SEMESTER

BEME802T3: INDUSTRIAL FLUID POWER (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes : Oil Hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids. Mechanical engineers come across such systems in all segments of industries.

This course is designed to understand the basic concepts of various components of hydraulic & pneumatic systems, the working principles of various components used for hydraulic & pneumatic systems, selection of appropriate components required for simple hydraulic and pneumatic circuits, listing probable causes of faults or defects in the components of hydraulic & pneumatic circuits. At the end of this course, students will be able to understand, discuss & apply the hydraulic & pneumatic systems in industries/applications.

UNIT – I **[8 Hrs.]**

Fluid power systems: Components, advantages, applications in the field of Machine tools, material handling, hydraulic presses, mobile and stationary machines, clamping and indexing devices, Transmission of power at static and dynamic states. Types of Hydraulic fluid petroleum based, synthetic and water based. Properties of fluids, selection of fluids, additives, effect of temperature & pressure on hydraulic fluids. Seals sealing materials, selection of seals, filters, strainers, sources of contamination of fluid & its control. Hydraulic and pneumatic symbols.

UNIT – II **[8 Hrs.]**

Pumps – Types of Pumps, vane pump, gear pump, gerotor pump, screw pump, radial and axial piston pumps. Power and efficiency calculations, selection of pumps for hydraulic power transmission.

Accumulators & Intensifiers: Types and functions of accumulators, intensifiers, applications, selection and design procedure.

UNIT – III **[8 Hrs.]**

Valves – Necessity of pressure control valves, direction control valves and flow control valves. Construction, working and symbols of pressure control valves – pressure relief valve, pressure reducing valve, pressure unloading valves and method of actuation of valves.
Direction control valves – Check valves, types of DC valves, poppet valve, spool valve, 2 way 2 position DC valve, 3 way 2 position DC Valve, 4 way 2 position D.C, 4 way 3 position D.C valves, rotary spool valves, open center, close center, and tandem center valves. Sequence valves, method of actuation of valves, manually operated, pilot operated and solenoid operated valves.

Flow control valves – Principle of operation, pressure compensated, non pressure compensated flow control valve, temperature compensated flow control valves. Meter in & meter out flow control circuits, bleed off circuits.

UNIT – IV **[8 Hrs.]**

Actuators- Construction, working and symbols of rotary actuators. Hydraulic motors.
Linear Actuators – Cylinders - Single acting, double acting, method of control of acceleration and deceleration. Calculation of piston velocity, thrust under static & dynamic applications.
Accessories – Pipes, hoses, fittings, oil filters, seals and gaskets.

UNIT – V **[8 Hrs.]**

Design of hydraulic circuits: Meter in, meter out circuits, bleed off circuit, sequencing circuit – travel dependant, pressure dependant hydraulic circuits for Milling machine & Shaper machine, motion synchronization circuit. Hydraulic circuits using sequence valves, counter balancing valves, unloading valves with the use of electrical controls. Trouble shooting and maintenance of hydraulic circuits.

UNIT – VI **[8 Hrs.]**

Introduction to pneumatic systems. Applications of pneumatic system, general layout of pneumatic system, merits and limitations of pneumatic systems.

Control Valves – Pressure regulating valves, flow Control valves, direction control valves.
Actuators – Rotary - Air motors, types, construction, working principle. Linear- Cylinders- Types, construction & working principle. Accessories – Pipes, Hoses, Fittings, FRL unit.

LIST OF TUTORIALS:

1) Study of hydraulic systems.
2) Demonstration of pneumatic systems.
3) Study of directional control valves.
4) Study of actuators.
5) Study of troubleshooting & maintenance of hydraulic circuit.
6) Study of troubleshooting & maintenance of pneumatic circuit.
7) Demonstration on meter in and meter out circuit.
8) Study of hydraulic circuit of Shaper machine.

TEXT BOOKS:

1. Oil Hydraulic system- Principle and maintenance, S.R Majumdar, Tata Mcgraw Hill Company.
2. Pneumatics Systems Principles and Maintenance, S.R Majumdar, Tata Mcgraw Hill Company.

REFERENCE BOOKS:

1. Introduction to Hydraulic & Pneumatics, S. Lango & V. Soundarajan, Prentice Hall of India.
2. Hydraulics and Pneumatics, H.L. Stewart, Industrial Press.
3. Fluid Power Design Handbook, Frank Yeaple, CRC Press.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that it this is to certify that it is a bonafide work entitled

ANALYSIS OF MOISTURE CONTENT AND ITS REMOVAL FROM COMPRESSED AIR OF INDUSTRIAL PNEUMATIC SYSTEM USING COMBINATION MOISTURE FILTERS

carried out by

Name of Students	Roll No
MISS. BHAVANA IKHAR	108
MISS. ASMA SHEIKH	109
MISS. MAYURI NIMJE	110
MISS. RASHMI MESHRAM	107
MISS. PRANITA SHELARE	106
MR. AYUSH JHA	158
MR. SAURAV S SINGH	160
MR. ANUJ SAHARE	161

Students of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Prof . Munindra S. Matey
Guide

Prof. P.M Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M.P. Singh
Principal

ABSTRACT

The air that is sucked in an air compressor is not at all clean. The presence of contaminants may have highly damaging effect on the finely finished mating surface of pneumatic components. The system pressure should also be stabilized and if needed lubricated before it is fed to the system. This is achieved by FRL unit. To supply of clean, pure and contamination free compressed air, the air requires to be filtered. A FRL unit is system which filters; regulate the compressed air before entering any pneumatic device. The biggest problem with compressed air is its moisture content which get condensed in the pneumatic system when put into use as pressure and temperature of air drops. This reduces the working life of pneumatic system component as the condensed air with impurities clogs & blocks the system. The present experimental design work analysis the reduction in moisture by using of combination of moisture separators. This will help in more efficient, cost effective and long lasting designs of pneumatic systems.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): SEVENTH SEMESTER

BEME702T5: ELECTIVE – I: SYNTHESIS OF MECHANISMS (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: This course is designed to understand the basic concepts of different mechanisms and its applications. The course also develops competency in graphical and analytical methods in solving problems of quantitative kinematic synthesis of mechanism. It also makes the students conversant with concepts of Kinematic synthesis, Path generation, Motion generation and Function generation. At the end of this course, students will be able to synthesize and develop the suitable mechanisms for various purposes/applications.

UNIT – I **[8 Hrs.]**

Introduction to Kinematic Synthesis:
Area of synthesis- Type, number and dimensional synthesis, mobility, Grublers criterion, class I & class II chain, Task of kinematic synthesis - function generation, path generation & motion generation problems with practical applications, concept of transmission angle, limiting conditions, toggle positions, circuit and branches in linkages, Grashof condition, coupler curves, Cognate-Robort-Chebyshev theorem.

UNIT – II **[8 Hrs.]**

Graphical Linkage Synthesis:
P recision points, structural error, mechanical error, Chebyshev spacing, selection of precision points, point position reduction technique, inversion technique, circle point curve, centre point curve, pole triangle, 3 position synthesis for the task of the kinematic synthesis. Path curvature theory- Eular-Savary equation, inflection points & inflection circle, Bobillier construction, Hartmann's construction, 4-position synthesis - point position reduction.

UNIT – III **[8 Hrs.]**

Analytical Linkage Synthesis:
complex number method- Modelling linkages with dyads for the task of kinematic synthesis, ground pivot specifications , Freudenstein's equation, Bloch's method of synthesis, matrix method approach, computer approach for the above problem.

UNIT – IV **[8 Hrs.]**

Optical Synthesis of a Planer Mechanisms:
Powell's search method, least square approximation, formulation for the task of kinematic synthesis.

UNIT – V **[8 Hrs.]**

Kinematic analysis of spatial mechanisms:
Kinematic analysis for linkages like RSSR, RRSS, RCCC Mechanism etc.

UNIT – VI **[8 Hrs.]**

Introduction to kinematics synthesis of Robot arms: Identification of task of mechanism for Robot, procedure and steps involved in kinematic synthesis in robotic applications.

LIST OF TUTORIALS:

1) Two problems on Path Generation Problem (Graphical approach).
2) Two problems on Motion Generation Problem (Graphical approach).
3) Two problems on Function Generation Problem (Analytical approach).
4) Two problems on Path Generation Problem (Analytical approach).
5) Two problems on Motion Generation Problem (Analytical approach).
6) Two problems on Function Generation Problem (Freudenstein Equation).
7) Complex number modeling for the mechanism synthesis problem. (Numerical).
8) Formulation for Optimal Synthesis of Function Generation Problem.
9) Formulation for Optimal Synthesis of Path Generation Problem.
10) Formulation for Optimal Synthesis of Motion Generation Problem.

TEXT BOOKS:

1. Theory of Machines and Mechanisms, J. E. Shigley and J. J. Uicker, McGraw-Hill.
2. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Robert L.Norton, Tata McGraw Hill.

REFERENCE BOOKS:

1. Advanced Mechanism Design–Analysis and Synthesis - Vol. I and II, A.G.Erdman and G.N. Sandor, Prentice – Hall.
2. Kinematics and Mechanism Design, C.H. Suh and C.W. Radcliffe, John Wiley & Sons.
3. Kinematics and Linkage Design, Hall, A.S., Balt Publishers.
4. Kinematic Synthesis of Linkages, R.S. Hartenberg and J. Denavit, McGraw Hill.
5. Kinematics and Dynamics of Machinery, R L Norton, McGraw Hill.

CERTIFICATE

This is to certify that the Dissertation Entitled

DESIGN AND FABRICATION OF WASTE REMOVER MECHANISM IN FOOD INDUSTRY

Is a bonafide work and is submitted to Rashtrasant Tukadoji Maharaj Nagpur University.

Submitted By

MR. GOPAL S JHA **MR. AYUSH AGARWALLA** **MR.ANKESH GUPTA**

MR. ARVIND SHARMA **MR. MD. FAIYAZ**

In the Partial Fulfilment of the Degree of BACHELOR OF ENGINEERING in Mechanical Engineering,
During the academic year 2016-2017 under my guidance.

Dr. K.S Zakiuddin
Head of Department

Ms. Sneha P. Gadpayle
Project Guide

Dr. M.K. Sonpimple
Co-Ordinator

Prof. P.M Sirsat
Project Incharge

Dr. M.P Singh
Principal

ABSTRACT

This project is focused on the removal of the food waste produced during the production of various food products. The project aims at easing the sweeping operation which is performed by the flap on the surface which is connected to the platform. This project consists of a stepper motor, a gear arrangement, chain drive and a platform consisting of a flap which is controlled by the Mechatronics system. Mechatronics system is used for the better control of the flap.

Initially the industry was having the problem of not being able to control the flap as well as the cost of the project was high, so they gave us the problem statement and asked for the solution. Here in this project we can successfully conclude that this project is economical as compared to the other available methods and the flap is successfully controlled by the mechatronics device (which are microcontroller, limit switch etc.).

This mechanism willreduce the human hazard which have been caused previously in the industry. This mechanism can work 24/7 without causing any casualty.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): EIGHTH SEMESTER

BEME803T3: ELECTIVE-III: RENEWABLE ENERGY SYSTEMS (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes : This course is designed to make the students conversant with the non conventional energy sources and their utilization to harness power. The students will learn the solar energy utilization with its applications. The students will also understand the various methods by which energy can be generated from wind, ocean tides, Geo-thermal phenomenon, Biogas and MHD. At the end of this course, students will appreciate the importance of renewable energy systems & will be able to build them.

UNIT – I **[8 Hrs.]**

Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry, solar angles, estimation of average solar radiation, radiation on tilted surface, tilt factors, solar fuel cell.

UNIT – II **[8 Hrs.]**

Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, transmissivity of glass cover system, collector efficiency, analysis of flat plate collector, fin efficiency, collector efficiency factor and heat removal factor, selective surfaces, evacuated collectors, novel designs of collector.

UNIT – III **[8 Hrs.]**

Concentric collectors: line focusing, point focusing and non focusing type, central receiver concept of power generations, compound parabolic collector, comparison of flat & concentric collectors. Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo-voltaics. Solar energy storage, sensible, latent and thermo chemical storage, solar pond.

UNIT – IV **[8 Hrs.]**

Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants, their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas production, digester design considerations, fuel properties of biogas and utilization of biogas.
Bio Mass :- Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification, classification of gasifiers & constructional details, chemistry of gasification, fuel properties, applications of gasifiers.

UNIT – V **[8 Hrs.]**

Wind and Ocean energy: - Power in wind, forces on blades. Wind energy: Basic principle of wind energy conversion, site selection consideration, wind data and energy estimation. Basic components of WECS classification of WEC systems, Savonius and Darrieus rotors applications of wind energy.

Ocean energy: Introduction, ocean thermal electric conversion, open and closed cycle of OTEC, hybrid cycle, energy from tides, basic principles of tidal power & components of tidal power plants. Single & double basin arrangement, estimation of tidal power and energy.

UNIT – VI **[8 Hrs.]**

Geothermal and MHD power generation:
Geothermal energy: Introduction, classification of geothermal systems, vapour dominated, liquid dominated system, total flow concept, petrothermal systems, magma resources, applications of geothermal operational & environmental problems.
Magneto Hydro Dynamic power generation: Introduction, principles of MHD power generation, MHD open and closed systems, power output from MHD generators.

LIST OF TUTORIALS: Tutorials based on above syllabus.

TEXT BOOKS:

1. Renewable Energy Recourses: Basic Principle and Applications: G.N.Tiwari and M.K. Ghosal, Narosa publication.
2. Non-Conventional Energy Resources: B.H. Khan, Tata McGraw Hill.
3. Solar Energy Utilization, G.D. Rai. Khanna pulishers.
4. Industrial Energy Conservation, D. A. Ray, Pergaman press.

REFERENCE BOOKS:

1. Non-Conventional Energy Sources , G.D. Rai, Khanna publishers.
2. Solar Energy, S.P. Shukhatme, Tata McGraw Hill Education.
3. Renewable Energy Sources and Emerging Tech., Kothari. PHI.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bonafide record of project work entitled

DESIGN AND FABRICATION OF SOLAR POWERED WATER PURIFIER

carried out by

Mr. PRIYAL BOPANWAR	**(233)**
Mr. SHUBHAM SUTRAPWAR	**(234)**
Mr. VIKRANT SOLANKEE	**(237)**
Mr. TARANG SAYAJA	**(238)**
Mr. PUSHPAK SELOKAR	**(239)**
Mr. TUSHAR SONKUSARE	**(240)**
Mr. SONAL SHAHARE	**(241)**
Mr. TUSHAR NAIDU	**(242)**

Students of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the RashtrasantTukadojiMaharaj Nagpur University, Nagpur.

Prof. Dr.K.S.ZAKIUDDIN
Guide

Prof. P. M. Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M. P. Singh
Principal

Date:
Place:

ABSTRACT

Water Purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal is to produce water fit for a specific purpose. The device used for this purpose is called as Water Purifiers. There are many kinds of water purifiers available in India today. Water Purifiers can be from just a simple water filter with filter cartridge element to the more advanced water purifier using membranes for water filtration followed by sterilization with UV filter. Most of the purifiers in India are working on Electricity. But in villages where there is no electricity people drink contaminated water without purification. This causes various water born diseases to the villagers. In Army camps and in the areas like forest, people do not have the electricity, so no source of purification.

In this proposed design Solar Power is used for purification of water. Solar Power is the conversion of sunlight into electricity either directly using photovoltaics or indirectly using concentrated solar power. In these purifiers using solar photovoltaics for conversion of sunlight into solar power. For purification of water six layer of purification is done . The first layer is of Sediment Block to get rid of lager solid particles like mud and dirt. The second and third layer is of carbon block which removes various dangerous organic chemicals like pesticides which may be present in water. The next layer is of UF Membrane which removes ultrafine materials present in water. The next one is of RO Membrane which is the smallest and can filter out dissolved chemicals out of water and thus convert salt water into fresh water. To reduce the power consumption UV LED's instead of UV Lamps is used to kill the remaining germs present in water and carry out sterilization of water effectively.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): SEVENTH SEMESTER

BEME702T2: ELECTIVE – I: TOOL DESIGN (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: This course deals with various types of cutting tools, the mechanics of metal cutting, design of gauges, design of metal cutting tools and also to understand various press working operations along with die design for sheet metal working, basics of forging dies and design of jigs and fixtures.

UNIT – I **[8 Hrs.]**

Theory of metal cutting: Introduction, cutting tool materials, different types of cutting tools used for machining, designation of cutting tools, different types of systems used for designating cutting tools, types of chips, Merchant's theory, determination of shear angle, velocity and force relationship, cutting power, energy. Tool wear, tool life criteria, variables affecting tool life, machinability.

UNIT – II **[8 Hrs.]**

Design of cutting tools: Design of single point cutting tools and form tools. Drills- Introduction, types, geometry, design of drills. Milling cutters – Introduction, types, geometry and design of milling cutters. Reamers, taps and broaches – Constructional features only.

UNIT – III **[8 Hrs.]**

Press working (Cutting operation dies): Introduction, different types of operations performed on presses, different types of presses, capacity calculation of presses. Different types of dies- Simple dies, compound dies, progressive dies, combination dies, transfer dies. Cutting operations, cutting force, methods for reducing cutting forces, cutting clearance, effect of cutting clearance on sheet metal, design of various types of dies for cutting operation.

UNIT – IV **[8 Hrs.]**

Press working (Bending. Forming & Drawing dies):

Bending: Bending terminology, types of bending operation, blank development, spring back and its prevention, bending force and design of bending dies.

Forming: Introduction, types of forming dies - Solid form dies, pad type form dies, curling dies, embossing dies, coining dies and its design.

Drawing: Metal flow in drawing operation, factors affecting metal flow, calculation of number of draws, development of blank, drawing force, blank holding force and design of various types of drawing dies i.e. single action draw die, double action draw die and inverted dies.

UNIT – V **[8 Hrs.]**

Forging die design: Introduction, classification of forging dies, single impression dies, multiple impression dies. Forging design factors – Draft, fillet and corner radius, parting line, shrinkage and

die wear, mismatch, finish allowances, webs and ribs. Preliminary forging operations – Fullering, edging, bending, drawing, flattering, blacking, finishing, cut off.

Die design for machine forging - Determination of stock size in closed and open die forging. Tools for flash trimming and hole piercing, materials and manufacture of forging dies.

UNIT – VI **[8 Hrs.]**

Design of jigs and fixtures: Introduction, concept of degrees of freedom, 3-2-1 principle of location, principles of location and clamping for jig and fixtures design, different types of locators and clamps, jig bushes, its types, materials and heat treatments, different types of jigs and its design.

Essential features of different types of fixtures, design of fixtures, indexing jigs and fixtures. automatic clamping devices.

LIST OF TUTORIALS: Tutorials based on above syllabus.

TEXT BOOKS:

1. Tool Design, Donaldson, Tata Mc-Graw Hill.
2. Fundamentals of Tool Design, Kempster
3. Computer Aided Fixture design, Rongi Yeming, Marcel Dekker Inc. NY.
4. Unconventional Clamping Systems by Juran and Grant.
5. Jigs and Fixtures Design by Joshi, Tata McGraw Hill.
6. Tool Design, S. K. Basu, India Book House.

REFERENCE BOOKS:

1. Fundamentals of Tool Design, Pollock, Reston Publishing Company.
2. Fundamentals of Tool Design, ASTME, Tata McGraw Hill.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bonafide record of project work entitled ***"Experimental Investigation of Laser Cutting Operation Performed on Sheet Metal"*** carried out by

Mr. Santosh Chakraverty	Mr. Satya Prakash
Mr. Sonu Kumar Prasad	Mr. Pankaj Kumar
Mr. Shubham Ramteke	Mr. Nilanjan Das

Mr. Ritesh Ranjan Mishra

Students of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfilment of the requirement for the Iaward of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Dr. C.N. Sakhale Guide, Associate Professor	Prof. A.S. Nilewar Co-Guide	Prof. P.M. Sirsat Project Incharge
Dr. M.K. Sonpimple ~~Associate~~ Professor, Co-Ordinator (I Shift)	Dr. K.S. Zakiuddin Professor & Head of Department	Dr. M.P. Singh Principal, PCE Nagpur

Date:

Place:

ABSTRACT

In manufacturing industries, laser is uniquely versatile tool for processing a remarkable range of metals, alloys, ceramics, glasses, polymers and composites. Fiber laser cutting, because of the narrow beam, small spot size, high intensity, depth of focus and easily absorbed by metal surfaces, present research work focuses on "fiber laser cutting process" out of all commercialized techniques for sheet metal cutting. The current research is based on experiments on cutting covering cutting of 5 mm thick mild steel, 3 mm thick stainless steel and 2.5 mm thick cold rolled carbon steel using the 1000 watt high power fiber laser machine. The cut qualities were analyzed by measuring the surface roughness, kerf width and perpendicularity by varying parameters like laser power, cutting speed and gas pressure. Nitrogen assist gas was used for cutting of stainless steel and oxygen was used for mild steel cutting. Material removal mechanism is keenly reviewed with different cutting approach with types of lasers. Potential of high power fiber laser is reviewed with different beam and process parameters with characteristic properties. Required experimental work is carried out with machine model "YLR-1000" - ytterbium fiber laser cutting machine and responses are measured by profile meter SJ-201 (Surface roughness tester - Mitutoyo) and UTHSCSA image tool version 3.0 program at Bajaj steel industries,G6-G7,Hingna MIDC,Nagpur.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): THIRD SEMESTER

BEME302T: KINEMATICS OF MACHINE (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: The study of kinematics is concerned with understanding of relationships between the geometry and the motions of the parts of a machine. The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to give desired motions. This course includes relative motion analysis, design of gears, gear trains, cams and linkages, graphical and analytical analysis of position, velocity and acceleration, clutches, brakes & dynamometers. Students will be able to understand the concepts of displacement, velocity and acceleration of simple mechanism, drawing the profile of cams and its analysis, gear kinematics with gear train calculations, theory of friction, clutches, brakes & dynamometers.

UNIT – I **[8 Hrs.]**

Basic concept of mechanism, link, kinematics pairs, kinematics chain, mechanism, Difference between machine and mechanism, Inversions, machine, simple & compound chain, Degrees of freedom, Estimation of degree of freedom of mechanism by Grubber's criterion and other methods. Harding's notations, Classification of four bar chain , Class-I & Class-II, Kutchbach theory, Various types of mechanism such as Geneva wheel, Paw1 and ratchet mechanism, Exact straight line mechanism, Approx. straight line mechanism, Transport mechanism.

UNIT – II **[8 Hrs.]**

Quantitative kinematics analysis of mechanisms: - Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method as well as analytical method. Coriolis component of acceleration, Instantaneous center method, Kennedy's theorem.

UNIT – III **[8 Hrs.]**

Concepts of cam mechanism, Comparison of cam mechanisms with linkages. Types of cams and followers and their applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic, SHM, cycloid etc.

UNIT – IV **[8 Hrs.]**

Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of involute gear tooth pair during the contact duration,

highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for involute profile teeth.

Kinematics of Spiral and helical gears, Kinematic analysis and torque analysis of simple epicyclic gear train.

UNIT – V **[8 Hrs.]**

Synthesis of Mechanism:- Introduction to type, Number and dimensional synthesis, Synthesis of Mechanism by graphical method, Transmission angle, Freudenstein's equation, Roberts Cognate Linkage.

UNIT – VI **[8 Hrs.]**

Laws of friction, Friction of inclined plane, Efficiency of inclined plane, Friction in journal bearing-friction circle, Pivots and collar friction-uniform pressure and uniform wear. Clutches, Brakes & Dynamometers: Single, multiple and cone clutch, Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamometers (Numerical are expected on clutches and brakes only).

LIST OF TUTORIALS:

1) Drawing sheets on Inversion of
   i) Class I & Class II four bar chain
   ii) Single slider crank chain
   iii) Double slider crank chain
2) Problem on degree of freedom of mechanisms
3) Problems on kinematic analysis i) Graphical method ii) Analytical method
4) Cam constructions
5) Problem on gears
6) Analysis of epicyclic gear train with torque analysis
7) Problems on synthesis
   i) Graphical method
   ii) Analytical method
8) Study of construction and working with neat sketch of
   i) Clutches
   ii) Brakes
   iii) Dynamometers

TEXT BOOKS:

1. Theory of Machine, S. S. Rattan, Tata McGraw Hill.
2. Mechanism and Machine Theory, J.S. Rao & Dukki Patti, New Age International (P) Ltd, Publishers.
3. Theory of Machines, P L Ballaney, Khanna Publications.

CERTIFICATE

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

This is to certify that this is a bonafide record of project work entitled **Model Fabrication of Speed Control Mechanism Using Variable Pulley**

carried out by

ABHAY PRATAP SINGH	**(120)**
AMIT KUMAR JHA	**(162)**
AKHILESH DEOGADE	**(148)**
AKHILESH KUMAR	**(142)**
DINONATH KHAN	**(154)**
GANESH SHINDE PATIL	**(152)**
MADAN KUMAR	**(151)**
PRATISHA BARMAN	**(157)**
SANAT MAHAPATRA	**(156)**

of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Prof. M.S. Giripunje
Guide

Prof. P. M. Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M. P. Singh
Principal

Date:

Place:

ABSTRACT

The Projects aims at designing and fabrication of speed Control of Mechanical Objects with the help of a Variable Pulley. The Projects aims at developing of a system to continuously supply power to any mechanical Object without the need of stopping the system. Now days the most common method to transmit power from one part of the system to the other is generally done by the use of gears in some system or pulleys in some, but one of the major disadvantage that occurs in each and every system is that a considerable amount of power is lost while the clutch is engaged or disengaged in case of a gear drive mechanism and in case of pulley drive mechanism the belt has to be completely shifted from one pulley to the other.

This project provides better utilisation of speed to any mechanical system by using the concept of transmitting of power through the pulleys, the same concept which is used in the continuously variable transmitting system (C.V.T). The major advantage in this type of transmitting system is that an infinite number of belt ratio can be obtained due to which the power can be transmitted with much higher efficiency.

Rashtrssant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): SEVENTH SEMESTER

BEME702T4: ELECTIVE – I: POWER PLANT ENGINEERING (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: This course aims to cover the detailed coverage of steam, hydro, nuclear, diesel and gas turbine power plant. It also introduces emerging technology in power generation like wood/biomass power plant, waste fire power plant. Considering current global environmental scenario, emphasis is stressed over solar hydrogen systems and fuel cell. It also aims to make the students aware about fluidised bed combustion which is one of the best clean coal technology which provides option for biomass conversion. It includes analytical and theoretical treatment of concepts with the right blend of theory design and practice of power stations along with detailing of combined cycle mode of power generation, in depth coverage of thermal, hydroelectric, nuclear, gas turbine and diesel power plant, in depth knowledge of emerging technologies (alternative power plants).

UNIT – I **[8 Hrs.]**

ECONOMICS AND POWER GENERATION:
Energy Introduction: - power and energy, sources of energy, Indian energy scenario.
Fluctuating loads: - Load curves, various terms and definitions, effect of fluctuating loads, Power and energy, sources of energy, numerical.
Economic analysis; - Tarrif load divison, cost of electricity, power plant economics, economic scheduling principle, numerical.

UNIT – II **[8 Hrs.]**

STEAM POWER PLANT:-.
Analysis of steam cycles: Ideal working fluid for vapour power cycles, Rankine cycle with regeneration and reheating, optimum degree of regeneration, feed water heaters.
Combine cycle power generation:-Binary vapour power cycles, combined cycle plants, gas turbine, steam turbine power plant, cogeneration.

UNIT – III **[8 Hrs.]**

COAL COMBUSTION AND STEAM GENERATORS:-
Coal –its properties, coal analysis, combustion reactions , actual air fuel ratio, draught, fans.
Combustion equipment for burning coal: - stoker, crushers, pulveriser, cyclone furnace, fuel firing methods, fluidized bed combustion.
Steam generators:- High pressure boilers, economiser, super heater, reheater, air preheater, electrostatic precipitator, fabric filter and bag houses, ash handling system, feed water treatment, steam turbine, condenser, cooling tower, steam power plant layout, pollution from steam power plant.

UNIT – IV **[8 Hrs.]**

HYDROELECTRIC POWER PLANT:-
Hydrology: - Rainfall runoff, hydrograph, flow duration curve, mass curve.

Hydroelectric power plant: - Site selection classification of hydroelectric power plant, details of different component, prime movers, governing, advantages and comparison with other power plants.

UNIT – V **[8 Hrs.]**

NUCLEAR POWER PLANT:-
Introduction to nuclear power plant: - Binding energy, energy release, nuclear reaction and its initiation, fission, component of nuclear reactors and its material, numerical based on energy release.
Nuclear reactor: - Types of reactor, PWR, BWR CANDU, gas cooled liquid metal fast breeder reactor, heavy water reactor and fusion power reactor.
Nuclear waste disposal: - Effect of nuclear waste on environment, its disposal to soil, water, air, sea etc., comparison with other power plants.

UNIT – VI **[8 Hrs.]**

Gas turbine power plant: Introduction, classification, various components, different arrangement, governing, methods to improve efficiency, comparison with other power plants.
Diesel power plant: - Introduction, outline type of engines, different components, performance, plant layout, comparison with other power plant.
Emerging technologies (alternative plants): Solar thermal conversion, photovoltaic power generation, solar hydrogen energy, fuel cell, wind energy, ocean energy, tidal energy, geothermal energy, MHD power generation. Wood/biomass power plant.

LIST OF TUTORIALS: Tutorials based on above syllabus.

TEXT BOOKS:

1. Power Plant Engineering, P. K. Nag, Tata McGraw Hill publication.
2. Power Plant Engineering, Domkundwar, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Power Plant Technology, M. M. EI-Wakil, McGraw Hill publication.
2. Power Plant Engineering, S.Gautam, Vikas Publication Pvt. Ltd.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bonafid.e record of project work entitled

DEVELOPMENT OF AUTOMOTIVE FUEL ENHANCEMENT SYSTEM

carried out by

Shubham Pathrabe	Umang Patel	Pushkar Pandhe
Prasad Umalkar	Shubhankar Pawshe	Mehul Lal

of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Prof. V. M. Sonde
Project Guide

Prof. P. M. Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M. P. Singh
Principal

Date:

Place:

ABSTRACT

In this project we have studied the basic properties of gas generated through electrolysis of water and then used this gas in the a bike as a fuel with gasoline by mixing it with air. This results the increased mileage of bike 30 to 60% and reduce the polluting contents from the exhaust gases.The threat posed by climate change and the striving for securities of energy supply are issues high on the political agenda these days. Governments are putting strategic plan motion to decrease primary energy use, take carbon out of fuels and facilitate modal shifts. Taking a prominent place in these strategic plans is hydrogen as a future energy carrier. Energy stored in hydrogen would be available at any time and at any place on Earth, regardless of when or where the solar irradiance, the hydropower, or other renewable sources such as biomass, ocean energy or wind energy was converted.. Hydrogen gas combined with the standard air/fuel mixture increases the mileage. This form of alternative fuel is provided by a hydrogen generator mounted in the vehicle. Once set up is ready, the hydrogen gas (fuel) will be produced from water, an electrolyte compound, and electricity supplied from a battery provided. Here we are designing a mixed fuel device for two wheeler.ie in a conventional SI engine we are incorporating traces of hydrogen along with gasoline in order to minimum consumption of gasoline as well as to increase the power of vehicle. Here in addition, a hydrogen generating unit is made to produce hydrogen .It is actually an electrolysis unit having high grade stainless steel/graphite/semiconductors as electrodes in a closed container and mixture of distilled water & suitable ionic solution(KOH or NAOH) as electrolyte. Power for electrolysis is taken from an additional battery provided (12V).This battery can be recharged from a dynamo/alternator/motor provided on the vehicle. Keyword- KOH, NAOH, SI engine, electrolysis of water ,hydrogen cell.

Rashtrssant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology B.E.
(MECHANICAL ENGINEERING): SEVENTH SEMESTER

BEME702T1: ELECTIVE-I: INDUSTRIAL ROBOTICS (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hours/Week	Duration of Paper:	03 Hours
Tutorial: 1 Hour/Week	University Assessment:	80 Marks
	College Assessment:	20 Marks

Course Objectives and Expected Outcomes: This course aimed to understand Robots, their components, functions, programming and applications. During this course students shall be able to describe industrial robot designs and how they are incorporated in industry. Further student will be able to identify robot classification systems, robot components, tooling, sensors and support systems. He will also learn; how robots are interfaced with other machines in the industrial setting and shall utilize learned techniques to program industrial robots, integrate robotics for different tasks.

UNIT – I **[8 Hrs.]**

Fundamentals of Robotics: Introduction Automation & Robotics robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot specifications, introduction to robot arm dynamics.

UNIT – II **[8 Hrs.]**

Robots end-effectors-classification of end-effectors, mechanical grippers, hooking or lifting grippers, grippers for molten metal's, plastics, vacuum cups, magnetic grippers, electrostatic grippers, multiple grippers, internal & external grippers, drive systems for gripers, active & passive grippers.

UNIT – III **[8 Hrs.]**

Robot Kinematics - Forward & reverse kinematics, forward and reverse transformation of two DOF & three DOF 2-D manipulator, homogeneous transformations. Robot drives & control-pneumatic power drives, hydraulic systems, electric drives, robot controllers-servo and non servo systems, motion control of robots, point to point and continuous path control, teaching of robots, robot programming methods. Basic control system models, slew motion, joint-interpolated motion and straight line motion.

UNIT – IV **[8 Hrs.]**

Robot Sensors: Scheme of robotic sensors, contact type sensors, force, torque, touch, position, velocity sensors, non-contact type sensors, electro-optical imaging sensors, proximity sensors, range imaging sensors, robot environment and robot input/output interfaces, machine intelligence, safety measures in robots.

UNIT – V **[8 Hrs.]**

Robot cell layouts, multiple robots and machine interface, other considerations in work cell design, work cell control, interlocks, error detection and recovery, work cell controller, robot cycle time analysis.

UNIT – VI **[8 Hrs.]**

Quantitative Techniques for economic performance of robots: Robot investment coats, robot operating expenses. General considerations in robot material handling, material transfer applications, pick and place operations, palletizing and related operations, machine loading and unloading, die casting, plastic moulding, forging, machining operations, stamping press operations using robots.

LIST OF TUTORIALS: Tutorials based on above syllabus.

TEXT BOOKS:

1. Robotics Technology & Flexible Automation, S. R. Deb, Tata McGraw Hill.
2. Industrial Robotics, M. P. Groover, McGraw Hill.
3. Robotics for Engineers, Y. Koren, McGraw Hill.

REFERENCE BOOKS:

1. Robots & Manufacturing Automation by Asfahal C. Ray, John Wiley.
2. Robotic Engineering, Richard D. Klafter, PHI.
3. Robots & Control, Mittal & Nagrath, Tata McGraw Hill.

Department of Mechanical Engineering,
Priyadarshini Engineering College of Engineering, Nagpur

CERTIFICATE

This is to certify that this is a bona fide record of project work entitled DESIGN & FABRICATION OF MULTI PURPOSE AGRI ROBOT carried out by

Mr. NARENDRA PANCHFULIWAR
Mr. YASH SHARMA
Mr. SUMIT TAGDE
Mr. RAUNAK LOYA
Mr. SHUBHAM DUDHBADE
Mr. PUNIT KAPSE
Mr. SUMIT SINGH
Mr. SWARUP TABHANE

Students of the B.E., Department of Mechanical Engineering, during the academic year 2016-2017, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering (Mechanical Engineering) offered by the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Prof. P. S.CHAUDHARI
Guide

Prof. P. M. Sirsat
Project Incharge

Dr. M. K. Sonpimple
Co-ordinator

Dr. K.S. Zakiuddin
Professor & Head of Department

Dr. M. P.Singh
Principal

Date:

Place: Nagpur

ABSTRACT

The project aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds, leveler to close the mud, sprayer to spray pesticides, bird hitter, insect killer, grass cutter, etc... these whole systems of the robot works with the battery and the solar power. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. The vehicle is controlled by Relay switch through IR sensor input. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of these robots are hands-free and fast data input operations. In the field of agricultural autonomous vehicle, a concept is been developed to investigate if multiple small autonomous machine could be more efficient than traditional large tractors and human forces.