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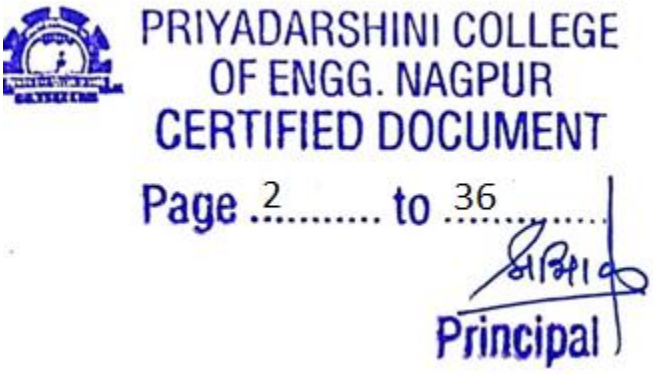
1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

2020-21



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**	**4,**
2	Machine Drawing	BEME306P		**29**
3	Design of Machine Elements	BEME502T		
4	Computer Aided Design	BEME703T/P		
5	Design of Mechanical Drives	BEME705T/P		
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	Dynamics of Machinery	PGMED102T		
11	Advanced Mechanical Drives	PGMED201T		
12	Design of Mechanical Handling System	PGMED203T		
13	Elective III-Tribology And Bearing Design	PGMED204T		
14	Finite Element Analysis	PGMED207P		
15	Elective IV-Finite Element Analysis	PGMED301T		
16	Elective IV-Optimization in Engg.	PGMED301T		

	Design			
17	Stress Analysis	PGMED202T/P		
18	Mechanical Vibrations	PGMED103T/P		
19	Advanced Mechanisms	PGMED101T/P		
20	Manufacturing Process	BEME304T/P	**Production**	**14, 18**
21	Machining Processes	BEME404T/P		
22	Advanced Production Processes	BEME503T		
23	Automation in Production	BEME804T/P		
24	Industrial Engineering	BEME701T		
25	Industrial Economics & Entrepreneurship Development	BEME501T		
26	Industrial Management	BEME801T		
27	Engineering Metallurgy	BEME305T/P		
28	Mechanical Measurement & Metrology	BEME505T/P		
29	Operations Research	BEME603T		
30	Elective – I: Industrial Robotics	BEME702T1		
31	Engineering Thermodynamics	BEME402T	**Thermodynamics**	**7, 10, 22, 26. 32**
32	Fluid Mechanics	BEME303T		
33	Hydraulics Machines	BEME403T/P		
34	Heat Transfer	BEME504T/P		
35	Energy Conversion- I	BEME601T		

36	Energy Conversion - II	BEME704T/P		
37	Energy Conversion - III	BEME805T/P		
38	Elective – II: Industrial Fluid Power	BEME802T3/ P3		
39	Elective – III: Renewable Energy Systems	BEME803T3		
40	Elective III-Design of Hydraulic And Pneumatic System	PGMED204T		
41	Industrial Visit	BEME507P	**Other**	
42	Industrial Case Study	BEME608P		
43	Mini Project	BEME407P		
44	Project Seminar	BEME706		
45	Project Seminar	PGMED303P		
46	Project	BEME806P		
47	Project	PGMED401P		
48	Control Systems Engineering	BEME602T		
49	Computer Applications – I	BEME506T		
50	Mechatronics	BEME604T/P		
51	Functional English	BEME606T		
52	Computer Applications – II	BEME607P		
53	Technical Report and Seminar	BEME307P		
54	Environmental Studies	BEME406T		

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

BEME502T: DESIGN OF MACHINE ELEMENTS (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to understand the basic machine element design. It includes the procedure of design (w.r.t. basic failures) under various loading conditions. Students shall understand design of various mechanical joints, machine components such as shaft, keys, brakes clutches, power screws etc. Apart from this, students shall learn spring design & pressure vessel design. At the end of this course, students will get familiar with design of these mechanical components under various loading conditions.

UNIT – I **[12 Hrs.]**

Introduction to Mechanical Engineering Design, Design methods, Aesthetic and Ergonomics Consideration in design , Material properties and their uses in design , Basic 'principles of Machine Design, Modes of failures, I. S. codes, Preferred Series and numbers. Design of Knuckle joint, Socket & Spigot type cotter joint. Design of riveted joint.

UNIT – II **[12 Hrs.]**

Design of bolted and welded joints under axial and eccentric loading conditions. Design of Brackets & Levers.

Design of Cylinder & Pressure Vessels: Types of pressure vessel, stresses induced in pressure vessel, Lame's, Clavarino's and Bernie's equations. Design of cylindrical & spherical pressure vessels. Design of nut, bolt, gasket & covers for pressure vessel.

UNIT – III **[12 Hrs.]**

Design of shaft for power transmission, static and fatigue criteria for shaft design, ASME codes for shaft design, Design of keys.

Design of Springs: Spring material, Helical compression & tension springs under static and variable loads, Leaf spring, Laminated Springs.

UNIT – IV **[12 Hrs.]**

Design of power screw: Thread forms, multiple threaded screws, terminology of power screw, design of screw jack.

Design of clutches and brakes: Single and multiple plate clutch, constant wear and constant pressure theory for plate clutches, Internal and external shoe brakes.

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TEXT BOOKS:

1. Design of Machine Elements, B.D.Shiwalkar, Central Techno Publications
2. Design of Machine Elements, V. B. Bhandari, Tata McGraw Hill Pub.
3. Mechanical Engineering Design, J. E. Shigley, McGraw Hill.
4. Design Data Book, B.D.Shiwalkar, Central Techno Publications.
5. Design Data Book, PSG.
6. Design Data Handbook Book, K. Mahadevan, CBS Publishers.
7. Mechanical Design of Machine Elements & Machines, J.A.Collins, Wiley India
8. Machine Components Design, Robert C., Juvinall & Kurt M. Marshek, Wiley India
9. Machine Design, U.C. Jindal, Pearson Publications
10. Machine Design : An Integrated Approach, Robert L Norton, Pearson Publications
11. Machine Design Fundamental and Applications, P.C. Gope, PHI Learning.
12. Design of Machine Elements, Sharma C.S. & Purohit K, PHI Learning.

REFERENCE BOOKS:

1. Design of Machine Elements, Spotts M. F. and Shoup T. E., Pearson Publications.
2. Machine Design, Black P. H. and O. Eugene Adams, McGraw Hill Book Co Inc.

Priyadarshini College of Engineering, Nagpur (M.S.)
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Design and Fabrication of Neem Seed De-Pulping Machine

Carried out by

Akshay Dilip Daf	Sarthak Premanand Dholey
Swarup Sanjay Gote	Umang Dayaram Umale
Aaftab Bakridan Ansari	Soham Vinod Ulmale

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** offered by **Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur (M.S.)**

S.D. Shelare
Guide

Prof. S.P. Lokhande
Project Coordinator

Dr. K.S. Zakiuddin
Professor & Head
Department of Mechanical Engineering
Prof. & Head
Dept. of Mechanical Engg.

Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

PRIYADARSHINI COLLEGE OF ENGINEERING NAGPUR PCE

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): FIFTH SEMESTER

BEME504T: HEAT TRANSFER (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to learn the various modes of heat transfer and laws associated with it. During this course, students can distinguish between steady state and unsteady state heat transfer; will be able to apply their knowledge of Dimensional Analysis to forced and free convection. Students will also be able to analyse radiation with and without radiation shield. Apart from this, students will also be able to analyse & design heat exchangers.

UNIT – I **[8 Hrs.]**

Introduction to basic modes of heat transfer, conduction, convection & radiation. Laws of heat transfer & conservation of energy requirement. General heat conduction equation in cartesian, cylindrical and spherical coordinates. One dimensional steady state heat conduction equation for the plane wall, cylinder and sphere, overall heat transfer coefficient. Thermal resistance of composite structure, contact resistance, variable thermal conductivity, critical thickness of insulation.

UNIT – II **[8 Hrs.]**

Conduction with internal heat generation for plane wall, cylinder and sphere. Extended surface, types of fins. Fins of uniform cross section area, temperature distribution and heat transfer rate, fin efficiency & effectiveness. Error in temperature measurement. Unsteady state heat transfer, lumped heat capacity analysis, Heisler's charts. Biot Number, Fourier's Number & its significance.

UNIT – III **[8 Hrs.]**

Forced convection, physical significance of non-dimensional parameter. Flow of high, moderate & low Prandtl number, fluid flow over a flat plate. Concept of hydrodynamics & thermal boundary layer thickness, local and average heat transfer coefficient. Empirical co-relations for external, internal flows, laminar & turbulent flow through conduits. Dimensional analysis applied to forced convection.

UNIT – IV **[8 Hrs.]**

Free or natural convection. Grashoff's number, Rayleigh number, flow over horizontal and vertical plate, Empirical Co-relations for cylinders and spheres, heat transfer with phase change, pool boiling curve & regimes of pool boiling, Film & Drop wise condensation, laminar film condensation on vertical surface, on horizontal tubes, effect of super heated & non-condensable gases on condensation heat transfer, Dimensional analysis applied to free or Natural convection.

UNIT – V **[8 Hrs.]**

Radiation, spectrum of radiation, black body radiation, radiation intensity, laws of radiation-Kirchoffs, Plancks, Weins displacement law, Stefan Boltzmann & Lamberts Co-sine law. Emissivity, Absorbtivity, Transmissivity, Reflectivity, Radiosity, Emissive power, Irradiation. Radiation network, radiation exchange between parallel plate cylinder & sphere, shape factor & its laws, radiation between parallel plates, cylinder & spheres. Radiation shields.

UNIT – VI **[8 Hrs.]**

Heat exchanger : Classification, overall heat transfer coefficient, fouling factor, LMTD & effectiveness, NTU method of heat exchanger analysis for parallel, counter flow & cross flow arrangement, design aspect of heat exchangers, Introduction to compact heat exchanger, Heat Pipe, Introduction to mass transfer.

TEXT BOOKS:

1. Heat Transfer, J.P. Holman, McGraw Hill Book Company, New York.
2. Fundamentals of Heat and Mass Transfer, K. N. Seetharam & T.R. Seetharam, Willey.
3. A Text Book of Heat Transfer, S.P. Sukhatme, University Press.

REFERENCE BOOKS:

1. Fundamentals of Heat and Mass Transfer, Venkanna B.K., PHI Publication.
2. Principles of Heat Transfer, Frank Kreith, Harper and Row Publishers, New York.
3. Heat Transfer - A Practical Approach, Yunus A. Cengel, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Heat & Mass Transfer, M.N. Ozisik, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Heat & Mass Transfer, R.K. Rajput, Laxmi Publication.

DATA BOOK: Heat & Mass Transfer, Domkundwar, Dhanapat Rai & Sons Publication.

Priyadarshini College of Engineering,Nagpur (M.S.)
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Thermal Performance Of Trapezoidal Fin Array With Different Cut Section At Centre Under Natural Convection To Enhanced The Heat Transfer

Carried out by

Abhishekkumar SN Jha	Arpit Vinod Kumar Nayak
Pankaj Kumar Pandit	Alpesh Uttam Dhone
Rupesh Singh Solanki	Mayur S Kale

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of Bachelorof Engineering offered by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur(M.S.)

Prof.N.R.PATHARE
Guide

Prof.S.P.Lokhande
Project Coordinator

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

Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

PRIYADARSHINI COLLEGE OF ENGINEERING PCE NAGPUR

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): EIGHTH SEMESTER

BEME802T3: INDUSTRIAL FLUID POWER (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
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.

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR (M.S)
DEPARTMENT OF MECHANICAL ENGINEERING

Certificate

This is to certify that this is a bonafide record of Project Work entitled

PNEUMATIC PIPE FEEDING AND CUTTING MACHINE

Carried out by

Nayan Bhowmik
MD Gufran Ahmad
Anup Chandra Paul
Azharuddin Khan
Debashish Das
Dipeshwar Bhorjekar
Priyanka Rahate
MD Ejaz Khan

Of 8th Semester

B.E.MECHANICAL ENGINEERING
During the academic year of 2013-14 in partial fulfillment of the requirement for the award of the degree of

BECHELOR OF ENGINEERING
Offered by the
RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR (M.S.)

Prof. P V Jadhav
(Project Guide)

Dr. Girish D Mehta
(II shift Co-ordinator)

Dr. K. S. ZAKIUDDIN
(HEAD OF THE DEPT.)

HOD MECH. ENGG.
PRIYADARSHANI COLLEGE
OF ENGG., NAGPUR.

Dr. M. P. SINGH
(PRINCIPAL)

III

ABSTRACT

In today automobile and industrial world, Pneumatic system play a vital role, it is actually an arrangement of different elements in order to regulate, direct, sense and command itself to achieve the desired result.

In Pneumatic system working media is fluid power. The term fluid power related to the employment of fluid media under control conditions to perform some useful work.

Fluid power in industries has been important in the development of automatic machinery and equipments for the use in industrial plants. The fluid media for power transmission has many advantages over the media of power transmission.

As a part of literature review different total presentation have been collected from the journals. These papers have been found to the co-related to project topic.

The system employs Pneumatic actuator for vertical and downward movement of pneumatic jack . Pneumatic actuator work on the command of direction control valve. The smooth movement of jack piston rod controlled through flow control valve.

The system been cost effective, has a wide applications which when implement can show good and effective result. It can be use deliberately in industrial applications, commercial and in automobile sectors where the requirements of automatic work demand.

Synchronization of various equipment involve in the system. Preparing a Pneumatic control system model and work on it is effectiveness.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): THIRD SEMESTER

BEME304T: MANUFACTURING PROCESSES (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to provide students with an overview of a wide variety of manufacturing processes for processing of engineering materials. Students will learn principles, operations and capabilities of various moulding, metal casting, metal forming, press working, metal joining processes & also processing on plastics. Upon completion of this course, students shall understand the importance of manufacturing processes and be able to select and apply suitable processes for an engineering product.

UNIT – I **[8 Hrs.]**

Pattern Making & Moulding: - Pattern making: Types, materials used, Pattern making allowances, color codes. Core making: - Types, core material & its properties. Moulding: Types of sand moulds, moulding sand composition. moulding sand properties, moulding machines. Shell moulding, CO_2 moulding.

UNIT – II **[8 Hrs.]**

Gating System & Casting Processes: - Gating design -Elements of gating systems, pouring equipments, riser design Melting furnaces -Types, Electric furnace, Induction furnace, Cupola-construction & operation. Cleaning, inspection & casting defects. Foundry mechanizing Special casting processes such as investment Casting, Centrifugal Casting, Slush Casting and Die Casting.

UNIT – III **[8 Hrs.]**

Joining Processes: - Introduction to metal Joining- Types of Welding. Arc Welding & Gas Welding Processes, Defects & Inspection of Welding Joints, Electrodes, weldability of Metals, Welding equipments. Fixtures, TIG Welding, MIG Welding, Spot Welding.

UNIT – IV **[8 Hrs.]**

Forming Process for metals:- Rolling, Forging, Extrusion, Drawing, Mechanics of forming process, Determination of Rolling pressure and roll specification force, drive force and torque, power loss in bearing, Determination of forging forces and stresses, Equipment (hammer/press) capacity required. (No analytical treatment)

UNIT – V **[8 Hrs.]**

Press Working: - Classification, types of presses, press terminology, Force analysis in press working, Die cutting operation, types of dies, Die and punch allowance, introduction to shaping operations, bending, forming and drawing.

UNIT – VI **[8 Hrs.]**

Introduction to Plastics, Properties & types, applications, Forming & Shaping of plastics – Extrusion, injection moulding, Blow moulding, wire drawing, Compression moulding, Transfer moulding, Embossing, Calendaring.

Introduction to Joining of Plastics- Mechanical Fastening, Spin Welding, Solvent Bonding, Ultrasonic welding, Induction welding, Dielectric welding, Hot Plate welding, Vibration welding, Hot gas welding.

TEXT BOOKS:

1. Workshop Practice, H. S. Bawa, Tata Mc-Graw Hill
2. Manufacturing Engineering & Technology, Kalpakjian, Pearson
3. Modern Materials and Manufacturing Process, R. Gregg Bruce, John E. Neely, Pearson Education
4. Workshop Technology (Volume I), Hajra Chaudhary, Media Promoters & Publishers
5. Workshop Technology (Vol. I & II), B. S. Raghuwanshi, Dhanpat Rai & Co.
6. Manufacturing technology (Vol. I), P. N. Rao, Tata Mc-Graw Hill
7. Manufacturing Science, Ghosh & Malik, East West Press.
8. Textbook of Production Engineering, P.C. Sharma, S. Chand & Co.

REFERENCE BOOKS:

1. Workshop Technology, Vol I & II, WAJ Chapman, Elsevier Butterworth-Heinemann.
2. Manufacturing Processes, M. Begman.
3. Processes & Materials of Manufacturing, R. Lindberg, Allyn & Bacon.

Priyadarshini College of Engineering, Nagpur (M.S.)
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Experimental study on Stresses of Dissimilar Joint of Austenitic and Ferritic Stainless Steel by Spot Welding Process

Carried out by

Akshay Chandrakant Kasarlewar	Upesh Dilip Hedaoo
Aditya Bandu Tikle	Aditya Eknath Kirnake
Tejas Vijay Bawane	Harish Gajanan Atkare

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** offered by **Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur (M.S.)**

C. K. Tembhurkar
Guide

Prof. S.P. Lokhande
Project Coordinator

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

Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

Principal
Priyadarshini College of Engg.
Nagpur

ABSTRACT

In this research, the strength on the tensile-shear of welding joints in spot welding of 15 mm thickness stainless steel sheets (SS316L, 430) was investigated. The welding joints were exposed to tensile shear using UTM and the effect of welding in tensile shear strength was researched by using related period diagrams. A weld current period and weld time is 3 – 6 kA and 2 – 5 second respectively was selected during the welding process. In this experiment increasing welding times cause high heat input to weld zone and extending weld nugget, so the strength of joints increases while excessive heat energy input causes void and crack formations, partially spurt out of molten metal and so, the strength of joint decreases. The ultimate stress obtained with experimental is 563.563 MPa where as from ANSYS R18.2 is 513.13 MPa. Finally, the comparison result shown the higher strength of orientation using spot welding machine is tensile shear type.

Rashtrasant 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.

Priyadarshini College of Engineering, Nagpur
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Hand motion controlled robotic vehicle

Carried out by

Pranit Kulkarni	Ruchik Yeole
Adarsh Sahare	Shubham Jondhale
Rushabh Jichkar	Rohit Selokar

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** offered by **Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.**

P.V. Jadhav
Guide

Prof. S.P. Lokhande
Project Coordinator

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

Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

PRIYADARSHINI COLLEGE OF ENGINEERING NAGPUR PCE

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ABSTRACT

In recent years, robotics is a demanding technology in the field of science. .To increase the use of robots where conditions are not certain such as security operations, robots can be made such that it will follow the instruction of human operator & execute the task. This paper describes about the gesture control robot which can be controlled by your normal hand gesture.. The accelerometer controls the movement of the car. Accelerometers are used to measure the angular displacement of human hand motion. It consists of mainly two parts, one is transmitter part and another is receiver part. The transmitter will transmit the signal according to the position of accelerometer attached on your hand and the receiver will receive the signal and make the robot move in respective direction. Here, the program is designed by using arduino. Any robot can be controlled by using arduino, and not only we can control it, but we can use it to do minimum 256 different functions.

In this project work we have designed a basic robotic chassis which can be easily controlled with the help of accelerometer instead of using button control. Here the most significant device is accelerometer. The accelerometer is the 3 axis estimation gadget with +-3g range. This gadget is made by utilizing polysilicon surface sensor and signal controlling circuit to quantify acceleration. The outcome of the accelerometer is analog in nature and corresponding to the acceleration. This gadget measures the static acceleration of gravity when we tilt it. And gives an outcome in type of movement or vibration.

The hand position is sensed and the coordinates generated is considered as the parameter and if necessary conditions are met, the statement prescribed in the arduino code is executed and the direction of the robot chassis is changed accordingly. So that it can perform the task such as forward moving, backward moving, turning left, turning right and stop. In many cases, the robot devices are some tough and complex while we control it with the help of buttons and switches.

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.

PRIYADARSHINI COLLEGE OF ENGINEERING,
NAGPUR (M.S.)
DEPARTMENT OF MECHANICAL ENGINEERING

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Session 2020-21

"DEVELOPMENT OF FUTURISTIC ELECTRIC VEHICLE CHARGING STATION: USING VERTICAL WIND AXIS TURBINE"

Carried out by

314	**Aniket Dhengre**	**319**	**Jay S Daware**
317	**Gaurav Borkar**	**336**	**Sagar V Surkar**
318	**Harshal Meshram**	**352**	**Lucky J Parate**

of 8th Semester
B.E. MECHANICAL ENGINEERING
during the academic year of 2020-2021 in partial fulfillment of the requirement for the award of the degree of
BACHELOR OF ENGINEERING
offered by

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR (M.S.)

Name of Project-Guide	**Prof. S. P. LOKHANDE**
Prof. N.R PATHARE	**(PROJECT COORDINATOR)**
Dr. K. S. ZAKIUDDIN	**Dr. M. P. SINGH**
(HEAD OF THE DEPT.)	**(PRINCIPAL)**

PRIYADARSHINI COLLEGE OF ENGINEERING NAGPUR PCE

ABSTRACT

The intention of this project is to design a Charging Station based on the renewable energy. The Fast-growing renewable energy sector in India is Wind Energy which is vital for economic growth of the country and since independence India has worked on their resources on increasing its energy capacity. Keeping this point of view the project studied the feasibility for installing the vertical axis wind turbine (VAWT) system especially at National Highways.

The project is designed with several types of blades for getting the efficiency and checking the potential of the design at ground level. The Model made was of Savonius type and DC motor was used inversely with Savonius input connected to motor shaft and electrical output was taken from the terminals of the motor. The efficiency is quite low but it can be usable power generated from nothing and have therefore advantage over Horizontal axis wind turbine (HAWT) plus on the contrary this can work on low heights thus these turbines can be installed on National Highways for electricity generation. The energy produced makes the model a reliable source of continuous energy.

This is a low-cost Vertical Axis turbine which is basically a test keeping development in view and the paper aimed to refine the design features and the fabrication techniques aim to make the device suitable for charging the electric vehicle. The paper content focuses on current India Scenario and potential of VAWT in India, advantages over HAWT keeping Indian Wind Energy industry, discussing its development and our project focus on harnessing this wind energy using a small axis wind turbine capable of working at low wind speed at low heights. The project considered the major drawback of wind generated power that is inconsistent power production caused by variability in

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): EIGHTH SEMESTER

BEME805T: ENERGY CONVERSION - III (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 includes the current energy scenario, various energy conservation techniques, energy auditing, study of various non conventional energy sources and their significance in present energy crises.. This subject also helps the students in understanding various Hydraulics and Pneumatic techniques used in various applications & industries.

UNIT – I **[8 Hrs.]**

Gas Turbines:-Ideal cycles isentropic and small stage efficiency, application of gas turbine pressure losses, effect of intercooling, reheat & regeneration, fuel-air ratio, combustion efficiency, performance calculation, open cycle &closed cycle gas turbine plants cogenerations & combined power cycles.

UNIT – II **[8 Hrs.]**

Principles & working of turbojet, tuboprop, Ramjet & pulse jet, simple turbojet cycle, thrust power, propulsive power. Thermal efficiency, propulsive efficiency, overall efficiency.

Nuclear Power Plant: Introduction, nuclear reactor, classification, general components, operation, problems of reactor operation, site selection, comparison of nuclear plants with thermal plants. (analytical treatment is not expected)

UNIT – III **[8 Hrs.]**

Principle of solar energy collection, solar energy and sources of power generation, solar constant, solar geometry, flat plate & concentrating collectors for water and air heating, solar energy storage, solar pond, application of solar energy for cooking, drying, solar photovoltaic system & its applications. Introduction to fuel cell. Working of wind generators & MHD generator (theoretical treatment is expected)

UNIT – IV **[8 Hrs.]**

Energy Auditing: Introduction, global and Indian energy scenario, need of importance of energy conversion. importance of energy audit, uses of energy audit, basic terms of energy audit, types of energy audit, procedure for carrying energy audit, instruments used for energy audit such as power analyzer, multipoint heat flow meter, Lux meter, portable infrared radiation thermometer, thermocouple based temperature indicator. Payback period, Return on Investment (ROI), life cycle costs, Sankey diagram, specific energy consumption.

UNIT – V **[8 Hrs.]**

Hydraulic systems: Introduction, essential elements of a hydraulic system: Flow actuators, directional control valves, pressure control valves, flow control valves, accumulators, basic hydraulic circuit, meter in & meter out circuits. Use of single, double actuator, crane, jacks. Grinding machine.

UNIT – VI **[8 Hrs.]**

Pneumatic Systems : Principle of pneumatics, comparison with hydraulic power transmission. Study of various Compressors used in pneumatic system, air preparatory unit, pneumatic valve. Various Pneumatic circuits.

LIST OF TUTORIALS: Tutorials based on above syllabus.

TEXT BOOKS:

1. Non-Conventional Energy Storage, Rai G.D., Khanna Ppublication.
2. Solar Energy Principles of Thermal Collection and Storage, Sukhatme, S.P., Tata McGraw Hill.
3. Industrial Hydraulics, John J. Pippenger, Tata McGraw Hill.
4. Pneumatic Systems, S. R. Mujumdar, Tata McGraw Hill.
5. Energy Conservation - related booklets published by National Productivity Council (NPC) & Petroleum Conservation Research Association.(PCRA).
6. Efficient Use of Electricity in Industries, B.G. Desai, M.D. Parmar, R. Paraman and B.S. Vaidya, ECQ series Devki R & D. Engineers, Vadodara.
7. Thermal Engineering, P.L. Ballaney, Khanna publishers.
8. Gas Turbine& Jet Propulsion, Dubey & Khajuriya, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Solar Energy Fundamentals and Applications, Garg, H.P., Prakash J., Tata McGraw Hill.
2. Gas Turbine Theory, Cohen and Rogers, Pearson.

Certificate

It is to certify that this is a bonafide record of Project Work entitled

"DESIGN AND DEVELOPMENT OF MOBILE OPERATED SOLAR GRASS CUTTER"

Carried Out By

ROBIN SINGH	ROHIT SURKAR
SAGAR DUDHABADE	VISHAL DUDHABADE
SHITAL LOKHANDE	AKASH MANDOKAR

of 8th Semester

B.E. MECHANICAL ENGINEERING

During the academic year of 2020 – 2021 in partial fulfillmentof

the requirement for the award of the degree of

BACHELOR OF ENGINEERING

offered by

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur (M.S.)

DR. VIVEK M. SONDE
(Project Guide)

PROF. S. P. LOKHANDE
(Project Coordinator)

DR. K. S. ZAKIUDDIN
(Head of the Dept.)

DR. M. P. SINGH
(Principal)

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Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): EIGHTH SEMESTER

BEME703T: COMPUTER AIDED 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 is aimed to develop; a framework where the designer works with computer to develop an Engineering system, CAD system that leads to effective use of computers in the entire design process, computer graphics & procedure about the geometrical modeling of engineering objects, controls on modeling parameter and graphics visualization techniques using computer. Further application of numerical method (FEA) for the analysis of mechanical elements is also included. At the end of this course, student will appreciate the importance of computers, computer graphics & numerical methods and will be able to use them for modeling, designing & analysis of mechanical components.

UNIT – I **[8 Hrs.]**

Introduction of CAD, Difference between Conventional & CAD design, Rasterisation techniques frame buffer, N-bit plane buffers, Simple color frame buffer algorithm for the generation of basic geometric entities like line, circle & ellipse by using parametric & non-parametric equations.

UNIT – II **[8 Hrs.]**

Introduction to windowing & clipping (excluding algorithm), Window and Viewport, line clipping & polygon clipping

2D transformation: Translation, Scaling, Rotation, Reflection & Shear, Concept of homogeneous representation & concatenation. Inverse Transformation (enumeration of entity on graph paper)

3D Transformation ; Translation, Scaling, Rotation, Reflection etc.

UNIT – III **[8 Hrs.]**

Techniques for Geometric Modeling:
Graphic standards, parametric representation of geometry, Bezier curves, Cubic spline curves, B-Spline curves, constructive solid geometry, Feature Based modeling, Feature recognition, Design by feature, Wire frame modeling, solid modeling of basic entities like box, cone, cylinder. CSG & B- representation technique using set theory.

Assembly modeling: Representation, mating conditions, representation schemes, generation of assembly sequences and importance of precedence diagram.

UNIT – IV **[8 Hrs.]**

Finite Element Analysis:
One Dimensional Problem: Fundamental concept of finite element method, Plain stress and strain, Finite Element Modeling, Potential Energy Approach, Galerkin Approach, Coordinate and Shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Quadratic Shape Function, Temperature Effects, Torsion of a circular shaft.

UNIT – V **[8 Hrs.]**

Truss & Two Dimensional FEM:
Plane truss problems, two dimensional problems using Constant strain triangle. Derivation of shape functions for CST element. Formulation of stiffness matrices for Truss and CST element. Preprocessing and Post processing.

UNIT – VI **[8 Hrs.]**

Optimization in Design:
Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equation, subsidiary design equations and limit equations, optimum design with normal and redundant specifications of simple machine elements like: tension bar, transmission shaft and helical spring.

LIST OF TUTORIALS: (at least Six)

1) Introduction to CAD softwares and DDA algorithm for Line generation.
2) Algorithm, flow chart and C-Program for Bressenham's Line generation
3) Algorithm, flow chart and C-Program for Bressenham's Circle generation
4) Algorithm, flow chart and C-Program for Bressenham's Ellipse generation or Ellipse generation using parametric equations.
5) Algorithm, flow chart and C-Program for Bezier Curve generation.
6) Two examples of two dimensional transformations.
7) Two examples on three dimensional transformations.
8) FE problems using one dimensional element (bar, temperature effect, torsion).
9) FE problems using plane truss element.
10) FE problems on two dimensional CST element.
11) Two numerical on optimization.

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Zeid Ibrham, Tata McGraw Hill.
2. CAD/CAM, Principles and Applications, P.N. Rao, McGraw Hill.
3. Computer Aided design and Manufacturing, Lalit Narayan, Rao & Sarcar, PHI pub.
4. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A.D., Prentice Hall India.
5. Finite Element Method with application in Engineering, Y.M. Desai, T.I. Eldho, A.H. Shah, Pearson publication.
6. Optimization: Theory and Practice, Joshi M.C, Narosa Publication.

REFERENCE BOOKS:

1. Computer Graphics, D. Hearn & M.P. Baker, Pearson.
2. Computer Graphics, S. Harrington, McGraw Hill.
3. Computer Control of Manufacturing Systems, Yoram Koren, McGraw Hill.

Priyadarshini College of Engineering, Nagpur (M.S.)
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Design, Drafting and Modelling of MEP Services For Hospital

Carried out by

Danish Ahamad Sheikh	Mansur Ahamad Ojas Kishor Kolhe
Vinit Shankar Lad	Pratik Gangadhar Giradkar
Pranay Tulshiram Halale	Mukul Mohan Khawaskar

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** offered by **Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur (M.S.)**

S.P. Lokhande
Guide

Prof. S.P. Lokhande
Project Coordinator

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

Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

PRIYADARSHINI COLLEGE OF ENGINEERING PCE NAGPUR

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): FOURTH SEMESTER

BEME403T: HYDRAULIC MACHINES (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 includes hydraulic turbines, centrifugal pumps, positive displacement pumps and miscellaneous water lifting devices. At the end of this course, students will understand practical applications of fluid; based on momentum and angular momentum principles involved in hydraulic machines. They will also understand design parameters and performance characteristics of various hydraulic machines & devices.

UNIT – I **[8 Hrs.]**

Compressible Flow:- Speed of Sound and the Mach Number, Isentropic Nozzle Flow, Normal Shock Wave, Shock Wave in Convergent-Divergent Nozzle, Vapour flow through Nozzle, Oblique Shock Wave, Isentropic Expansion. Introduction to impact of jet.

UNIT – II **[8 Hrs.]**

Theory of turbo machines and their classification, Elements of hydro-electric power plant, Impulse Turbine:- principle, constructional features, Installation of Pelton Turbine, Velocity Diagram and Analysis, Working proportions, Design parameters, Performance characteristics, Governing.

UNIT – III **[8 Hrs.]**

Reaction or pressure Turbine:- principles of operation, Degree of reaction, comparison over Pelton Turbine, Development of reaction turbine, Classification, Draft tube, Cavitation in Turbine, Francis Turbine, Propeller Turbine, Kaplan Turbine:- Types, Constructional features, Installations, Velocity Diagram and analysis, Working proportions, Design parameters, Performance characteristics, Governing, selection of turbines.

UNIT – IV **[8 Hrs.]**

Hydrodynamic pumps:- Classification and Applications, Centrifugal pumps:- Principle of operation, Classification, Component of Centrifugal Pump installation, Priming methods, Fundamental equation, Various heads, Velocity heads, Velocity triangles and their analysis, slip factor, Effect of outlet blade angle, Vane shapes, Losses and Efficiencies of pumps, Multi staging of pumps, Design Consideration, Working proportions, N.P.S.H., Cavitations in pumps, Installation and operation, Performance characteristics, Pump and system matching and Introduction to self priming pumps.

UNIT – V **[8 Hrs.]**

Positive Displacement Pumps:- Basic principle, Classification, Reciprocating Piston / Plunger Pumps:- Types, Main Components, Slip, Work Done, Indicator Diagram, Cavitations, Air vessels, Gear pump, Screw pump, Vane pump.

UNIT – VI **[8 Hrs.]**

Similitude: - Types of similarities, Dimensionless number and their significance, Unit and Specific Quantities, Model Testing: - Application to hydraulic turbine and hydrodynamic pumps, Miscellaneous Water Lifting Device: - Air lift pumps, Hydraulic Ram, Submersible pump, Regenerative pumps.

LIST OF TUTORIALS:

1) Selection of Turbine
2) Design of centrifugal Pumps
3) Design of Francis Turbine
4) Design of reciprocating Pumps
5) Governing of Turbines
6) Study of Hydro-Kinetic System

TEXT BOOKS:

1. Fluid Mechanics & Fluid Power Engineering – D. S. Kumar, S.K. Kataria & Sons Publications
2. Fluid Mechanics & Machines – R. K. Bansal, Laxmi Publications

REFERENCE BOOKS:

1. Fluid Mechanics with Engineering Applications, E. Finnemore & Franzini, Tata Mc-Graw Hill
2. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
3. Fluid Mechanics, A. K. Jain, Khanna Publishers
4. Hydraulic & Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill
5. Mechanics of Fluids, Merle C. Potter, CL-Engineering
6. Fluid Mechanics, John F. Douglas, Pearson

Priyadarshini College of Engineering, Nagpur (M.S.)
Department of Mechanical Engineering

Certificate

It is to certify that this is a bonafide record of Project Work entitled

Design and Development of Mechanical Wheel Dolly

Carried out by

Akash Rajendra Meshram	Amol Santosh Kamble
Punit Surshyam Shende	Satyam Dani Prasad Sinha
Mayur Mahadevrao Satpute	Kamlesh Kumar Gaurishankar Sah

8th Semester B.E. Mechanical Engineering during the academic year of 2020-21 in partial fulfillment of the requirement for the award of the degree of **Bachelor ofEngineering** offered by **Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur (M.S.)**

Dr. P.S. Chaudhari
Guide

Prof. S.P. Lokhande
Project Coordinator

Dr. K.S. Zakiuddin
Professor & Head
Department Of Mechanical Engineering

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Dr. M.P. Singh
Principal
Priyadarshini College of Engineering

ABSTRACT

A wheel dolly is disclosed that is suited to serve as both an automobile jack, capable of holding large loads aloft for extended periods, relying on only mechanical systems and eliminating hydraulic systems. In a further aspect, the wheel dolly of the present invention does not include extended arms, handles, or levers for pumping or rotating the lifting mechanisms. Each lifting element terminates in only a single nut exposed to the user. Preferably, each nut of each lifting system has the same plan dimensions as the other, thus providing the advantage of allowing the user to operate the dolly with a driver and only one socket