**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**
**Choice Based Credit System (CBCS)**
**Scheme of Teaching and Examination 2019 – 20**
**(Effective from the academic year 2019 – 20)**

**V Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in hours | SEE Marks | CIE Marks | Total Marks | |
| 1. | HU | 19HU51 | Entrepreneurship, Management And Finance | Humanities/Program | 3 | - | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 2 | PC | 19AU52 | Heat Transfer | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 3 | PC | 19AU53 | Computer Aided Design and Manufacturing | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 4 | PC | 19AU54 | Design Of Machine Elements -I | Automobile Engineering | 3 | 2 | -- | -- | 03 | 50 | 50 | 100 | 4 |
| 5 | PC | 19AU55 | Automotive Chassis and Suspension Systems | Automobile Engineering | 3 | - | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 6 | PC | 19AU56 | Automotive Auxiliary and Electrical Systems | Automobile Engineering | 3 | - | - | 1 | 03 | 50 | 50 | 100 | 4 |
| 7 | HU | 19HU01 | Soft Skill | Humanities | -- | -- | 2 | -- | 02 | 50 | 50 | 100 | 1 |
| 8 | PC | 19AUL51 | Mechanical Measurements and Instrumentation Lab | Automobile Engineering | -- | -- | 2 | -- | 03 | 50 | 50 | 100 | 1 |
| 9 | PC | 19AUL52 | Fuels and Lubricants Testing Lab | Automobile Engineering | -- | -- | 2 | -- | 03 | 50 | 50 | 100 | 1 |
| 10 | PC | 19AUL53 | CAD/CAM Lab | Automobile Engineering | -- | -- | 2 | | 03 | 50 | 50 | 100 | 1 |
| **Total** | | | | | **20** | **02** | **08** | **01** | **31** | **550** | **550** | **1100** | **24** |

**Note: Hu: Humanities, PC: Professional core, NCMC: Non-credit mandatory course.**
Note: Management and Enterpreneurship course shall be offered by CV, ME, IP, Auto and CCT Departments at V semester level and E&CE, CSE, IS, IT and E&E departments at VI semester level

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**
**Scheme of Teaching and Examination 2019– 20**
**(Effective from the academic year 2019 – 20)**

**VI Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Week | | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in hours | SEE Marks | CIE Marks | Total Marks | credits |
| 1. | PC | 19AU61 | Automotive Transmission | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 2. | PC | 19AU62 | Design of Machine Elements -II | Automobile Engineering | 3 | 2 | -- | -- | 03 | 50 | 50 | 100 | 4 |
| 3. | PE | 19AU63X | Elective- 1 | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 4. | PE | 19AU64X | Elective- 2 | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 5. | IE | 19AU65X | Industrial Elective | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 6. | OE | 19AU6OE | Open Elective- 1 | Automobile Engineering | 3 | -- | -- | -- | 03 | 50 | 50 | 100 | 3 |
| 7. | HU | 19HU02 | Aptitude | Automobile Engineering | -- | -- | 2 | -- | 02 | 50 | 50 | 100 | 1 |
| 8. | PC | 19AUL61 | Automobile Engineering Lab - I | Automobile Engineering | -- | -- | 2 | -- | 03 | 50 | 50 | 100 | 1 |
| 9. | PC | 19AUL62 | Automobile Engineering Lab - II | Automobile Engineering | -- | -- | 2 | -- | 03 | 50 | 50 | 100 | 1 |
| 10. | MP | 19AUMP63 | Mini-project | Auto | - | -- | 4 | -- | 03 | 50 | 50 | 100 | 2 |
| 11. | INT | 19AUIN64 | Internship | (To be carried out during the intervening vacations of VI andVII semesters ) | | | -- | -- | - | -- | -- | -- | - |
| **Total** | | | | | **18** | **02** | **10** | **00** | **29** | **500** | **500** | **1000** | **24** |

**Note: PC: Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-project, INT: Internship.**

**Internship:** All the students admitted to III year of BE/B.Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters.
Note Management and Enterpreneurship course shall be offered by CV, ME, IP, Auto and CCT Departments at V semester level and E&CE, CSE, IS, IT and E&E departments at VI semester level

**Elective –1: 18AU631** Operations Research, **18AU632:** Non Traditional Machining, **18AU633:** Engineering Economics and Cost Estimation.
**Elective – 2: 18AU641:** Mechatronics, **18AU642:** SQC, **18AU643**: Autotronics, Industrial Elective:
**Open Elective -1**: **18AU66OE:** Biomass and Bio Energy

**Detailed syllabus for V and VI sem 2019-20 entry students**

| **Course Title: Entrepreneurship, Management And Finance** | | |
|---|---|---|
| **Course Code** | **19HU51** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module – I**<br><br>**Entrepreneur :** Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Intrapreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD. | | **08 hours** |
| **Module – II**<br><br>**Management:** Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Roles of Management, Levels of Management, Henry Fayol - 14 Principles to Management , Engineers Social responsibility and Ethics | | **08 hours** |

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| **Module - III**<br><br>**Preparation Of Project And Source Of Finance:**<br>Preparation Of Project: Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents;<br>**Source Of Finance:** Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc) | **08 hours** |
| **Module - III**<br><br>**Fundamentals Of Financial Accounting:** Definition, Scope and Functions of Accounting , Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet | **09 hours** |
| **Module - V**<br><br>**Personnel Management, Material Management And Inventory Control:**<br>**Personnel Management:** Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives<br><br>**Material Management And Inventory Control:** Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level ( Re-order level, Minimum level, Maximum level, Average level and Danger level) | **09 hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

**Text books:**

1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N & Maheswari S K-Vikas Publishing House.
2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications ,Prof Manjunatha & Amit kumar G – laxmi Publication, Veerbhadrappa Havina l-New Age International Publications.
3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi

**Reference Books:**

1.Industrial Organization & Engineering Economics-T R Banga & S C Sharma- Khanna Publishers, Dehli.

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AU51** | **CO1** | Develop Entrepreneurship skills |

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| | **CO2** | Apply the concepts of management and Engineers Social responsibility & Ethics practice |
| | **CO3** | Prepare project report & choose different Source of Finance. |
| | **CO4** | Apply Fundamentals of Financial Accounting and interpret the final accounts |
| | **CO5** | Apply personnel management skills, Material and inventory control techniques |

| Course Title: Heat Transfer | | |
|---|---|---|
| **Course Code** | **19AU52** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **03 (Theory) + 1(Tutorial)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **52** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction and Basic Equations:** Conduction, Convection, Radiation, Combined heat transfer mechanism. Boundary conditions, General form of one-dimensional heat conduction equation in rectangular, cylindrical and spherical co-ordinates. Numerical.<br><br>**One Dimensional, Steady State Heat Conduction:**<br><br>Linear heat flow through the slab, the cylinder, the sphere, Composite medium. Thermal contact resistance. | | **10 Hours** |
| **Module - II**<br><br>**Critical Thickness of Insulation and Variable Thermal Conductivity:** Critical thickness of insulation, Conduction in solids with variable thermal conductivity**.**<br><br>**Heat Transfer Through Extended Surfaces:** Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin effectiveness and fin efficiency. | | **10 Hours** |

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| **Module - III**<br><br>**Forced Convection:** Introduction, Application of dimensional analysis for forced convection problems. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers, use of Empirical correlations for flow over a flat plate, over a cylinder and across a tube bundle (Simple Numerical)<br>**Free Convection:** Application of dimensional analysis for free convection-physical significance of Grashoff number; Use of Empirical correlations for free convection from or to vertical, horizontal and inclined flat plates. (Simple Numerical) | **10 Hours** |
| **Module - IV**<br><br>**Boiling and Condensation:** Types of Condensation; Nusselt's theory for laminar condensation on a vertical flat surface; Expressions for film thickness & heat transfer co-efficient. Use of correlations for<br><br>Condensation on inclined flat surfaces, horizontal tube & horizontal tube banks. Reynolds number for condensate flow; Regimes of pool boiling, Pool boiling correlations.<br><br>**Heat Exchanger:** Classification, overall heat transfer coefficient, fouling factors, LMTD and NTU methods of analysis of heat exchangers. | **12 Hours** |
| **Module - V**<br><br>**Radiation I:** Thermal radiation, definitions of various terms used in radiation heat transfer; Stefan Boltzmann law, Kirchhoff's law, Planck's law. Wien's displacement law. Intensity of radiation, Lambert's law<br><br>**Radiation II:** Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces. Effect of radiation | **10 Hours** |

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**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

**Text books:**

Heat transfer- A practical approach by Yunus. A. Cengel, Explain and Evaluate radiation heat exchange.

Heat transfer by M N Ozisik, Tata Mc Graw Hill Co-Ltd, New Delhi.

**Reference Books:**

Heat transfer by P.K Nag, Tata Mc Graw Hill Publishing co-Ltd, New Delhi.

A Course in Heat and Mass Transfer - Domkundwar, Dhanpat Rai

Heat transfer – J.P.Holman

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AU52** | **CO1** | Describe modes of heat transfer and analyze conduction heat transfer |

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| | | in plane wall, cylinder and sphere with different boundary conditions. |
| | **CO2** | Calculate critical thickness of insulation, temperature distribution and heat transfer through extended surfaces. |
| | **CO3** | Interpret and compute forced and free convective heat transfer. |
| | **CO4** | Analyze boiling and condensation heat transfer and heat exchangers |
| | **CO5** | Illustrate and predict radiation heat exchange. |

| **Course Title: Computer Aided Design and Manufacturing** | | |
|---|---|---|
| **Course Code** | **19AU53** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |

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| **Module – I**<br><br>**Introduction:** CAD/CAM defined, the product cycle and CAD/CAM, Automation and CAD/CAM.<br><br>**Conventional Numerical Control:** Introduction, basic components of an NC system, the NC Procedure, NC coordinate system, NC motion control systems, applications of numerical control, and economics of numerical control. | **08 hours** |
| **Module – II**<br><br>**Nc Part Programming:** Introduction, the punched tape in NC, tape coding and format, manual part programming, computer assisted part programming, the APT language the MACRO statement in APT, advantages of CAD/CAM in NC programming, voice NC programming. Simple programs. | **08 hours** |
| **Module - III**<br><br>**CNC Machines:** Overview of different CNC machining centers, CNC turning centers, high speed machine tools. ROBOT TECHNOLOGY: Introduction, robot physical configurations, basic robot motions, programming the robot, robot programming languages, end effectors. Work cell control and interlocks, robotic sensors ,robot applications | **09 hours** |
| **Module - IV**<br><br>**Group Technology:** Introduction, part families, parts classification and coding, three parts classification and coding systems, Group technology machine cells, Benefits of Group technology. | **08 hours** |

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| **Computer Aided Proces Planning:** The planning function, Retrieval type Process planning systems, Generative Process planning systems, Benefits of CAPP. Machinabilty data systems, Computer generated time standards. | |
| **Module - V**<br><br>**Computer-Aided Quality Control:** Introduction, Terminology in quality control, The computer in quality control, Contact inspection methods, Non-Contact inspection Methods (Optical and Non Optical) ,Computer Aided testing ,Integration of CAQC with **CA/CAM.**<br>**Computer Integrated Manufacturing:** Introduction, types of manufacturing systems, machine tools and related equipment, material handling system, computer control system, human lab our in manufacturing system, CIMS benefits. | **09 hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

**Text books:**

1. Groover and Zimmers, " CAD / CAM: Computer Aided Design and Manufacturing ",
2. P.N.Rao, " Computer Aided Design and Manufacturing ", ", McGraw- Hill Book

Company, New York, 1976.

**Reference Books:**


1. Sadhu Singh, " Computer Aided Design and Manufacturing ", Khanna Publishers,New Delhi, 1998.
2. D.F. Rogers and J.A.Adams, " Mathematical Elements in Computer Graphics ",McGraw-Hill Book Company, New York, 1976.
3. P.Radhakrishnan and C.P.Kothandaraman, " Computer Graphics and Design ",Dhanpat Rai and Sons, New Delhi, 1991.
4. E.Dieter George, " Engineering Design ", McGraw-Hill International Edition, 1991.
5. P.Radhakrishnan and S.Subramanyan, " CAD / CAM / CIM ", Wiley Eastern Ltd.,New Age International Ltd., 1994.
6. Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw- Hill Publishing Co.


**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AU53** | **CO1** | Discuss the role of CAD/CAM in manufacturing and NC Machines. |

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| | **CO2** | Know about CNC Machines and Robot Technology. |
| | **CO3** | Develop G-codes, M-codes & APT language programming for machining of mechanical parts. |
| | **CO4** | Describe the concept of Group Technology and Computer Aided process planning. |
| | **CO5** | Study the basics of computer Aided quality control and computer Integrated Manufacturing. |

| **Course Title: Design of Machine Elements – I** | | |
|---|---|---|
| **Course Code** | **19AU54** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 (Theory)+1 (Tutorial)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction:** Basic concept of machine design, classification of | | |

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| design, factors to be considered in machine design, materials and their properties, codes and standards.<br><br>**Design against static loading:** Modes of failure, Factor of safety, stress- strain Relationship, shear stress and shear strain, stresses due to bending moment, stresses due to torsional moment, eccentric axial loading, principal stresses.<br><br>**Theories of failure**: maximum-normal stress theory, maximum shear stress theory, distortion energy theory, selection and use of failure theories. | **09 hours** |
| **Module - II**<br><br>**Design against fluctuating loading:** Stress concentration, stress concentration factors, reduction of stress concentration, fluctuating stresses, S-N diagram, Endurance limit, modifying factors, Notch sensitivity, Fatigue strength under fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage. | **08 hours** |
| **Module - III**<br><br>**Design of shafts:** Torsion of shafts, design for strength and rigidity, ASME codes for design of transmission shafting, shafts under fluctuating loads and combined loads.<br><br>**Design of simple machine elements:** Design of Cotter and knuckle joints. Types of keys, stresses in keys, design of keys. Design of rigid flange coupling and bush pin type flexible coupling. | **09 hours** |

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| **Module - IV**<br><br>**Riveted and welded joints:** Riveted joints: Introduction, methods of riveting, types of riveted joints, types of failure, strength equations, efficiency of joint, design of simple riveted joints, boiler joint and lozenge joint. Welded joints: advantages and disadvantages of welded joints over riveted joints, design of parallel and transverse fillet welds and determination of size of weld subjected to eccentric loading. | **08 hours** |
| **Module - V**<br><br>**Power screws:** Power screws, forms of threads, force analysis of power screws, stresses in power screws, efficiency and self-locking.<br><br>**Threaded joints:** Introduction, effects of initial tension, effect of compression, effect of fatigue loading, impact loading, shear loading and eccentric loading. | **08 hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

**DESIGN DATA HAND BOOKS:**

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. Design Data Hand Book by K. Mahadevan and Balaveera Reddy, CBS Publication
3. Machine Design Data Hand Book by H.G. Patil, Shri Shashi Prakashan, Belgaum.
4. PSG design data handbook by PSG College of Technology, Coimbatore.

**Text Books:**

1. Mechanical Engineering Design: Joseph E Shigley and Charles R.Mischke. McGraw Hill International edition, 6th Edition 2003.
2. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing company Ltd., New Delhi, 2nd Edition 2007.

**Reference Books:**

1. Machine Design: Robert L. Norton, Pearson Education Asia, 2001.
2. Design of Machine Elements: M.F.Spotts, T.E. Shoup, L.E.Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006.
3. Machine Design: Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New

Delhi, Special Indian Edition, 2008.

4. Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek,Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

5. Machine Design : R.S Khurmi, J K Gupta

6. Design of Machine Elements Vol. I & II – T Krishna Rao

7. Design of Machine Elements Vol. I & II – J B K Das & Srinivasmurthy

8. Design of Machine Elements Vol. I & II- M Ravidra

**E books and online course materials:**

1. https://nptel.ac.in/downloads/112105125/
2. https://nptel.ac.in/courses/112105124/
3. https://nptel.ac.in/courses/112106137/

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 19AU54 | CO1 | Apply the stress analysis, theories of failure and material science in the design of machine components. |
| | CO2 | Formulate proper assumptions for the analysis of different machine components subjected to stress concentration and dynamic loads. |
| | CO3 | Adopt standard practices in the design and analysis of shafts, cotter joint, knuckle joint and couplings. |

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| | **CO4** | Design riveted and welded joints. |
| | **CO5** | To analyze and design power screws with respect to torque requirements & overhauling and design threaded joints. |

| Course Title: Automotive Chassis and Suspension Systems | | |
|---|---|---|
| **Course Code** | **19AU55** | **CIE: 50** |
| **Number of Lecture hours/Week** | **03 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Chassis and Frames:** Introduction to chassis; Classification of chassis.<br><br>**Frames:** Introduction; functions, Types of frames; Various loads on chassis frames, Chassis operating conditions; Chassis frame sections; Defects in frame; calculation of stresses on sections constructional details testing of frames bending and torsion test. Numerical problems. | | **09 Hours** |
| **Module - II**<br><br>**Front axle:** Introduction, functions, construction, types of front axle, Stub axle, front axle loads<br><br>**Steering systems:** Purpose, functions, requirements, layout of steering system, Steering gears, Steering ratio, factors of wheel alignment, wheel balancing, correct steering angle, steering mechanisms, cornering force, self righting torque, under steer and over steer, Steering linkages, power steering, trouble shooting, | | **08 Hours** |

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| Numerical problems. | |
| **Module - III**<br><br>**Propeller shaft:** Construction & types of propeller shafts, whirling of propeller shaft, **Universal joints:** Construction and working; analysis of Hooke's Joint.<br><br>**Final drive and Differential:**Construction details of final drives, Constructional details, types and working principle of differential.<br><br>**Rear axle:** Introduction, types of rear axles, Rear axle ratio, overall gear ratio. Numerical problems. | **08 Hours** |
| **Module - IV**<br><br>**Brakes:**Necessity, functions, requirements, classification of brakes, types, construction, function, operation, braking systems - mechanical, hydraulic, disc, drum, details of hydraulic system, mechanical system and components, types of master & wheel cylinders, bleeding of brakes, brake drums, brake linings, brake fluid, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Parking and emergency brakes, hill holder, automatic adjustment, servo brakes, Power brakes-Air brakes, vacuum brakes and electric brakes ; stopping distance and time, brake efficiency, weight transfer, brake shoe theory, determination of braking torque, trouble shooting, Numerical problems. | **08 Hours** |
| **Module - V** | |

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| **Suspension:** Objects, requirements, basic considerations, Types of suspension springs, construction , operation & materials, leaf springs, coil springs, torsion bars, rubber springs, air and gas springs, hydraulic suspension, constructional details of telescopic shock absorbers, independent suspension, front wheel independent suspension, rear wheel independent suspension, types, stabilizer, trouble shooting.<br><br>**Wheels and Tyres:** Requirements of wheel. Types of wheels, construction, structure and function.<br><br>Tyres: functions, requirements of tyres, Types of tyres, tyre construction, tyre inflation pressure,tyre materials, tyre section & designation, factors affecting tyre life, cause of tire wear, tyre marking, wheel balance, trouble shooting. | **09 Hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

**Text books:**

1. Automotive chassis-P H Heldt, Hilton company.
2. Automobile Engineering - N K Giri, Khanna publications New Delhi
3. Automobile Engineering Vol. I & II – Kirpal Singh, Standard Pub, New Delhi, 1984.
4.Automobile Engineering – R.K. Rajput, Laxmi Publications.

**Reference Books:**

1. Automobile engineering – G B S Naranga, khanna publication

2. Automotive mechanics- Joseph I Heitner, affliated east west press,New Delhi/Madras.

3. Automobile engineering- Dr.Kirpal singh volume I&II, standard publisher distrubutor.

4. Automotive chassis and body- P.L.Kohli, tmh publications.

5. Introduction to Automobile engineering:-N.R. khatawate, khanna publication New Delhi.

6. Automobile engineering-T.R.banga and Nathusingh, khanna publication New Delhi 1993,

**E books and online course materials:**

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AU55** | **CO1** | Explain different chassis layouts and frames solve for stability and weight distribution and frame suitability. |
| | **CO2** | Describe, about various Front Axles, factors of wheel alignment Steering Systems. |
| | **CO3** | Discuss about various types Propeller Shaft, Differential And Rear Axles |
| | **CO4** | Compare various types of Brakes. Analyze the break efficiency and stopping distance |
| | **CO5** | Describe Various Types of Suspensions, Wheels and Tyres. |

**Course Title: Automotive Auxiliary and Electrical Systems**

| Course Code | 19AU56 | CIE: 50 |
|---|---|---|
| Number of Lecture Hours/Week | 04 (Theory) | SEE: 50 |
| Total Number of Lecture Hours | 52 | SEE Hours: 03 |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Petrol Injection System:** Types of injection systems, components Electronic fuel injection system, merits and demerits; MPFI system.<br><br>**Diesel Fuel Injection:** Introduction to fuel injection system (FIS), functional requirements of FIS functions and objectives of injection system, types of FIS, fuel injector, fuel injection nozzles, fuel injection pumps. | | **12 Hours** |
| **Module - II**<br><br>**Cooling System:** Necessity, function, principle, variation of gas temperature, piston and cylinder temperature, cooling systems; air cooling and water cooling system, comparison, thermostats and radiators.<br><br>**Supercharging And Turbo charging:** Introduction, objectives of supercharging, thermodynamic cycle, supercharging in SI engines, supercharging of CI engines, limits of supercharging for petrol and diesel engines. Modification of an engine for supercharging. Methods of supercharging, superchargers, turbo charging (Buchi System), methods of turbo charging. | | **10 Hours** |

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| **Module - III**<br><br>**Lubrication System:** Introduction, objectives, requirements**,** functions, hydrodynamic theory of lubrication, types of lubrication systems, properties of lubricants, types, and additives in oil.<br><br>**6. Storage Battery :** Principle of lead acid cells, plates and their characteristics containers and separators, electrolyte and their preparation, effect of temperature on electrolyte, its specific gravity, ratings, capacity and efficiency, battery tests ,methods of charging from DC mains, defects and remedies of batteries, new batteries. | **10 Hours** |
| **Module - IV**<br><br>**Charging System:** Introduction to charging system, requirements ,Generator (Dynamo) details, working principle of dynamo , parts of dynamo , operation Dynamo regulation, third brush control, Cut out relay, Regulators for D C generators. Alternator; advantages, working principle, constructional details and operation.<br><br>**Starting System**: Introduction, principle, construction, working, starting motor drive mechanism, starting torque and power requirements, torque terms and trouble shooting | **10 Hours** |
| **Module - V**<br><br>**Ignition System**: Introduction, purpose, requirements, types of ignition systems, ignition timing, spark advance mechanism, spark plug.<br><br>**Wiring and Lighting System:** Earth return and insulated systems, low and high voltage automobile cables. Principle of automobile | |

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| illumination, head lamp mounting and construction, sealed beam auxiliary lightings, horn, signaling devices, fuel, oil and temperature gauge**.** | **10 Hours** |

**Course outcomes:**

After studying this course, students will be able to:

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

**Text books:**

1. A Course in I. C. Engines – Mathur and Sharma, Dhanpat Rai & Sons, NewDelhi, 1984

2. Automobile Engineering Vol. I & II – Kirpal Singh, Standard Pub, New Delhi, 1984.

3. Internal combustion engines – V Ganesan

4. Automobile Electrical and Electronic systems - Tom Denton, SAE publication, 2000.

5. Automobile Electrical Equipment - P.M. Kohli, Tata McGraw Hill

**Reference Books**:

1. I.C Engines – H.B.Keshwani, Standard Pub. New Delhi, 1982

2. Fundamentals of I. C. Engine – J. B. Heywood

3. Automobile Electrical Equipment - A.P. Young & Griffiths,

4. Modern Electrical Equipment – A.W. Judge,

5. Electrical Equipment for Automobiles - by Parker and smith S.

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AU56** | **CO1** | Explain automotive injection systems. |
| | **CO2** | Discussion on automotive cooling systems, supercharging and turbo charging. |
| | **CO3** | Illustrate automotive lubrication system and automotive storage battery |
| | **CO4** | Describe different charging system and Starting system |
| | **CO5** | Explain automotive ignition system, wiring and lighting systems. |

| Course Title: Mechanical Measurements and Instrumentation Lab | | |
|---|---|---|
| **Course Code** | **19AUL51** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **2 (Practical)** | **SEE: 50** |
| **Total Number of Hours** | **28** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **METROLOGY:**<br>1. Calibration of a micrometer using slip gauges<br>2. Measurements using optical projector / Tool makers microscope.<br>3. Measurements of angle using sine center/sine bar/bevel protractor.<br>4. Measurements of alignment using auto collimator.<br>5. Measurements of screw thread parameters using two wire or three wire method.<br>6. Measurements of surface roughness using | | |

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|---|---|
| mechanical comparator /Talysurf.<br>7. Measurements of gear tooth profile using vernier gear tooth calipers.<br>8. Measurements using optical flats.<br>**INSTRUMENTATION ENGINEERING:**<br>1. Calibration of LVDT.<br>2. Calibration of load cell.<br>3. Calibration of thermocouple.<br>4. Calibration of pressure gauge.<br>5. Calibration of proving ring. | **28 hours** |

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AUL51** | **CO1** | To demonstrate the concepts of metrology and instrumentation |
| | **CO2** | To exhibit the skills of performing experimental tasks related to metrology and instrumentation |
| | **CO3** | To share the responsibility and contribute as a member of a team |
| | **CO4** | To analyze the data and interpret data to take valid decisions. |
| | **CO5** | To prepare report about the experimental work |

| Course Title: Fuels and lubricant Testing Lab | | |
|---|---|---|
| **CourseCode** | **19AUL52** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **2 (Practical)** | **SEE: 50** |

| Total Number of Lecture Hours | 28 | SEE Hours: 03 |
|---|---|---|
| **Modules** | | **Teaching Hours** |
| 1. Introduction<br>2. Grease drop and grease Penetration Test<br>3. Carbon Residue Test<br>4. Distillation experiment<br>5. Determination of flash and fire Point using Pensky Martin's and Abel's Apparatus<br>6. Determination of Viscosity Using Redwood and Saybolt Viscometer<br>7. Cloud and Pour point test<br>8. Study of Calorimeters | | **28 hours** |

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AUL52** | **CO1** | Conduct the experiments to determine grease penetration and dropping point of grease. |
| | **CO2** | Conduct the experiments to determine the flash point, fire point, cloud point and pour point of petroleum products. |
| | **CO3** | Conduct the experiments to determine the distillation characteristics and viscosity of petroleum products. |
| | **CO4** | Conduct the experiments to determine the amount of carbon residue of petroleum products |
| | **CO5** | Study of calorimeters. |

| Course Title: CAD/CAM -Lab | | |
|---|---|---|
| **Course Code** | **19AUL53** | **CIE: 50** |
| **Number of lecture Hours/Week** | **2 (Practical)** | **SEE: 50** |
| **Total Number of Hours** | **28** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| 1.Manual Part Programming for CNC Machines using Stand G and M Code - Simulation of tool path - Machining practical on Trainer Type CNC Machines.<br><br>2. Using Pro E or any other standard solid modular getting a hard copy of different automotive components.<br><br>3. Study of NC machines and simulation of cutting/milling operations using CAM packages.<br><br>4.Machining /simulation of at least two jobs using NC machine/ CAM packages.<br><br>5. Analysis of simple automotive components by using FEM packages.<br><br>6.Making free hand sketches and 3D drawings of typical | | 28 hours |

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| subassemblies-Cotter and Knuckle joints, Riveted joints, couplings-flange, flexible, universal,. (Using CAD package) | |

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 19AUL53 | CO1 | To demonstrate the concepts of manual part programming |
| | CO2 | To exhibit the skills of performing programming tasks related to NC machines, CNC machines. |
| | CO3 | To share the responsibility and contribute as a member of a team |
| | CO4 | To analyze the data and interpret data to take valid decisions |
| | CO5 | To prepare report about the experimental work |

**Course Title: Automotive Transmission**

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|---|---|---|
| **CourseCode** | **19AU61** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **4 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **52** | **SEE Hours: 03** |

| Modules | Teaching Hours |
|---|---|
| **Module -I**<br><br>**Clutch:** Necessity of clutch in an automobile, requirements of clutch, different types of clutches and their working, clutch troubles and their causes, clutch materials, numerical on torque transmitted | |

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| by single plate, multi plate and cone clutches.<br><br>**Power Required For Propulsion:** Various resistances to motion of automobile, Traction and tractive effort, relation between engine revolutions and vehicle speed, Road performance curves: Acceleration Gradability, drawbar pull, | **10 hours** |
| **Module - I**<br><br>**Gear Box:** The need for transmission, necessity of gear box, Constructional details of slidingmesh gearbox, constantmesh gear box, synchromesh gearbox, calculation of gear ratios, performance characteristics in different gears, desired ratios of speed in 3 speed and 4 speed gear box, auxillary transmissions, compound transmissions, numerical calculations. | **10 hours** |
| **Module - III**<br><br>**Fluid Couplings And One Way Clutches:** construction and working of fluid couplings, percentage of slip, fluid coupling characteristics, one way clutches (over running clutch),construction and working, necessity and field of application,<br><br>**Torque Convertors:** Introduction to torque convertors, comparison between fluid couplings and torque converters, construction and working of single phase and multi phase torque converters, performance characteristics, principles of torque multiplication, typical hydrodynamic transmission., | **11 hours** |
| **Module - IV** | |

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| **Epicyclic Transmission:** Principle of operation, types of planetary transmission, Wilson planetary transmission, Ford –T model gear box, Pre –selective mechanisms, CVT, hydraulic control in planetary transmission, over drives, cotal spicyclic transmission. Automatic transmission-Principle and general description | **10 hours** |
| **Module - V**<br><br>**Hydrostatic Drives:** Principles of hydrostatic drives, different systems of hydrostatic drives, constant displacement pump and constant displacement motor, variable displacement pump and constant displacement motor, variable displacement pump and variable displacement motor constant displacement pump and variable displacement motor applications, plunger type pump plunger type motor, advantages and limitations, typical hydrostatic drives, hydrostatic shunt drives.<br><br>ELECRICAL TRANSMISSION: Ward-leonard principle of electric drives: working principle, advantages and limitations. Hybrid vehicle. | **11 hours** |
| **Question paper pattern:**<br><br>1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.<br><br>2. Five full questions are to be answered selecting at least One full question from each Module. | |

3. Each question should not have more than 3 sub divisions

**Text books: Text Books:**

1. Automotive Mechanics – N.K Giri
2. Automotive Vehicle Transmission – John Wiley publications

**Reference Books:**

1. Heldt. P.M. " Torque Converters"
2. Newton and Steeds. "Motor Vehicles"
3. Judge A W. "Modern Transmission systems"
4. SAE Transactions 900550 & 930910
5. Crouse W H, Anglin D.L. "Automotive transmission and power trains construction "McGraw Hill"

**E books and online course materials:**

https://www.springer.com/in/book/9783642162138

https://study.com/transmission_course.html

https://www.vidyarthiplus.com/.../Thread-AT2301-Automotive-Transmission-Full-Lec.

https://www.svce.ac.in/.../auto/.../III%20YEAR%20CLASS%20NOTES/.../UNIT%20I...

**Course outcomes:**

| On completion of the course, the student will have the ability to: | | |
|---|---|---|
| **Course Code** | **CO #** | **Course Outcome (CO)** |
| **19AU61** | **CO1** | Calculate power requirements for propulsion and determine clutch dimensions. |
| | **CO2** | Analyze gear ratios and applications of gear box.. |
| | **CO3** | Explain Working of fluid couplings, torque convertors and their performance Characteristics. |
| | **CO4** | Illustrate constructional details and working of automatic transmissions. |
| | **CO5** | Interpret the principles of hydrostatic transmission and electric systems |

| Course Title: Design of Machine Elements – II | | |
|---|---|---|
| **Course Code** | **19AU62** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 (Theory)+1 (Tutorial)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Curved Beams:** Differences between Straight & curved beam, Derivation of bending Stress equation for a curved beam subjected to pure bending. Stresses in curved Beams subjected to Direct and Bending loading of Standard cross sections (Circular, Rectangular, Trapezium, Triangle, I & T Sections) used in crane hook, punching presses & clamps.<br>**Springs:** Types of springs, terminology – Stresses in Helical coil springs of circular and non-circular cross sections, Energy stored in springs. Concentric springs, springs under fluctuating loads. Leaf Springs: Stresses in leaf springs, nipping & Equalized stresses. | | **10 hours** |
| **Module-II**<br><br>**Spur Gears:** Terminology, Forces analysis, Beam strength of spur gear tooth. Lewis Equation and form factor, Design for strength, Dynamic Load and wear load.<br>**Helical Gears:** Terminology, Forces analysis, formative/virtual number of teeth, and Beam strength of helical gear tooth. Lewis Equation and form factor, Design for strength, Dynamic Load and | | **08 hours** |

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| wear load. | |
| **Module - III**<br><br>**Worm Gears:** Terminology, Forces analysis, efficiency of worm and worm gear, worm gear strength, Thermal capacity of worm gear sets.<br>**Bevel Gears:** Terminology, Forces analysis, formative/virtual number of teeth, Beam strength of straight tooth Bevel gear, Design for strength, Dynamic Load and wear load. | **08 hours** |
| **Module-IV**<br><br>**Lubrication & Journal bearings:** Types of lubrication, lubricants and properties, viscosity, bearing materials. Journal bearing-Terminology, Bearing Modulus, Minimum oil film thickness. Coefficient of Friction, Summerfield number, Heat generated & Dissipated. Design of journal bearing using Petroff's, McKee's equation.<br>**Rolling contact bearings:** Types & classification, Terminology-Life, Static & dynamic load capacity, equivalent load, Load-life relationship, Design – finding Life, selection from manufacturer's catalogue. | **08 hours** |
| **Module -V**<br><br>**Design of IC Engine components:** Cylinder & cylinder head, piston, Connecting rod, Valve and valve operating mechanism. | **08 hours** |
| **Question paper pattern:** Two questions from each module to be set and students have to answer one question from each module | |

**Text books:**

**Design Data Hand Books:**

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.

2. Design Data Hand Book by K. Mahadevan and Balaveera Reddy, CBS Publication

3.Machine Design Data Hand Book by H.G. Patil, Shri Shashi Prakashan, Belgaum.

4. PSG design data handbook by PSG College of Technology, Coimbatore.

**Text Books:**

1. Mechanical Engineering Design: Joseph E Shigley and Charles R.Mischke.

   McGraw Hill International edition, 6th Edition 2003.

2. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing

   companyLtd., New Delhi, 2nd Edition 2007.

**Reference Books:**


1. Machine Design: Robert L. Norton, Pearson Education Asia, 2001.
2. Design of Machine Elements: M.F.Spotts, T.E. Shoup, L.E.Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006.
3. Machine Design: Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.
5. Machine Design : R.S Khurmi, J K Gupta
6. Design of Machine Elements Vol. I & II – T Krishna Rao

7. Design of Machine Elements Vol. I & II – J B K Das & Srinivasmurthy
8. Design of Machine Elements Vol. I & II- M Ravindra

**E books and online course materials:**

1. https://nptel.ac.in/downloads/112105125/
2. https://nptel.ac.in/courses/112105124/
3. https://nptel.ac.in/courses/112106137/

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 19AU62 | CO1 | Analyze and design curved beams. |
| | CO2 | Explain the theory and design of helical compression springs and leaf springs. |
| | CO3 | Design spur and helical gears for static and dynamic loading along with wear strength & design of bevel and worm gears. |
| | CO4 | Design Journal bearings and select roller bearing from manufacturer's catalog. |
| | CO5 | Determine the major dimensions of IC Engine components. |

| Course Title: Operations Research [Elective - I] | | |
|---|---|---|
| **Course Code** | **19AU631** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **04 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **52** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction to OR:** Definitions, Phases of OR study and applications of OR.<br><br>**LPP –I:** Mathematical Formulation, Standard Form, basic Solutions, Feasible Solutions, Optimal Solutions, Degenerate solutions, Graphical Solutions.<br><br>**LPP – II**: Simplex method, Two Phase and Big-M methods, Unbounded, Infeasible and alternative solutions. Resolving degeneracy in LPP**.** | | **12 Hours** |
| **Module - II**<br><br>**Transportation Problem - I:** Formulation of Transportation Model, Basic Feasible solution by NWC Rule, Row Minimum, Lowest cost entry and Vogel approximation methods.<br><br>**Transportation Problem –II:** Optimality methods, unbalanced problem, degeneracy in transportation. | | **10 Hours** |

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| **Module - III**<br><br>**Assignment problem:** Formulation, Hungarian Method, Unbalanced problem, Assignment for maximization, travelling salesman problem.<br><br>**Sequencing:** Processing of 2 jobs on 'N' Machines and 3 jobs on 'N' machines, 'm' jobs on 'N' machines and graphical procedure for 2 jobs on 'M' machines. | **10 Hours** |
| **Module - IV**<br><br>**CPM & PERT**: Network Construction, CPM: determination of critical path and Total elapsed time, Concept of slack and Float PERT, Estimation of Project duration and Variance, analysis about the completion of projects.<br><br>**Queuing Theory. Queuing system:** Types and Characteristics, Steady state analysis of M/M/1 and concept of M/M/K model. | **10 Hours** |
| **Module - V**<br><br>**Game Theory:** Formulation of Games, Characteristics of games, Two-Person Zero Sum game, Maximin/ Minimax principle, Saddle point, games without saddle point, solution for (2 X 2) game, dominance property, Graphical solution for (2 x n) and (n x 2) games.<br><br>**Replacement problem:** Basic Concept of Replacement of items that deteriorate with time: costs involved Replacement procedure with and without consideration of Time value of money. | **10 Hours** |

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| Replacement of items that fail suddenly: Group Replacement. | |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

**Text books:**

1. S.D.Sharma –"Operations Research", Kedarnath, Ramnath and Co.

2. Taha S A –"Opeartions Research and Introduction", McMillian

**Reference Books:**

1. Philips, Ravindran and Soeberg- "Principles of Operations research", PHI

2. Hiller and Liberman-" Introduction to Operations Research", McGraw Hill V Edn

3. A.M. Natarajan , P Balasubramani, A Tamilarawari - Operation Research

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|

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|---|---|---|
| **19AU631** | **CO1** | Analyze the characteristics of different types of decision making process using LPP . |
| | **CO2** | Formulate and solve transportation problems |
| | **CO3** | Analysis of assignment problems and sequencing of jobs |
| | **CO4** | Evaluate project duration using network analysis and interpret Queuing system theory. |
| | **CO5** | Develop critical thinking and objective analysis of decision problems and replacement problem. |

| **Course Title: Non Traditional Machining** | | |
|---|---|---|
| **Course Code** | **19AU632** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 hrs. (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction:** History, Classification, comparison between | | |

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| conventional and Non-conventional machining process selection.<br><br>**Ultra Sonic Machine (USM)**: Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:-Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM. | **8 Hours** |
| **Module - II**<br><br>**Abrasive Jet Machining (AJM)**: Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery | **8 Hours** |
| **Module - III**<br><br>**Electrochemical Machining (ECM):** Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & | **8 Hours** |

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| insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations | |
| **Module - IV**<br><br>**Chemical Machining (CHM):** Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps – masking, Etching, process characteristics of CHM: material removal rate accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.<br><br>**Electrical Discharge Machining (EDM):** Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear , EDM tool design choice of machining operation electrode material selection, under sizing and length of electrode , machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy surface finish, Heat Affected Zone. Machine tool selection, Application EDM accessories / applications, electrical discharge grinding, traveling wire EDM. | **9 Hours** |
| **Module - V**<br><br>**Plasma Arc Machining (PAM):** Introduction, equipment no thermal | |

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| generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.<br><br>**Laser Beam Machining (LBM):** Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.<br><br>**Electron Beam Machining (EBM):** Principles, equipment, operations, applications, advantages and limitation of EBM | **9 Hours** |

**Question paper pattern:**

1.Total of Ten Questions with Two questions from each Module to be set covering the Entire syllabus.

2. Five full questions are to be answered selecting at least One full question from Each module.

3. Each question should not have more than 3 sub divisions

**Text books:**

1.Davis H.E Troxel G.E Wiskovil C.T the Testing instruction of Engineering materials Mc graw hill

**Reference Books:**

1. McGonnagle JJ "Non Destructive testing" – Garden and reach New York
2. Non destructive Evolution and quality control" volume 17 of metals hand book 9 edition Asia internal 1989.

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 19AU632 | CO1 | Discuss the introduction to NTM and ultra sonic machine (usm):.. |
| | CO2 | Know about abrasive jet machining process. |
| | CO3 | Explain about electrochemical machining and its process. |
| | CO4 | Describe about chemical machining and electrical discharge machining process. |
| | CO5 | Describe about plasma arc machining, laser beam machining and electron beam machining process. |

| Course Title: Engineering Economics and Cost Estimation | | |
|---|---|---|
| **Course Code** | **19AU633** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 hrs. (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction**: Definition of various economic terms such as economic goods, utility, value, price, wealth, wants capital, rent and | | |

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| profit, Laws of returns.<br><br>**Demand And Supply:** Law of diminishing utility and total utility. Demand Schedule .Law of demand. Elasticity of demand, Law of substitution, Law of supply, supply schedule, elasticity of supply. | **8 Hours** |
| **Module - II**<br><br>**Wages:** Nominal and real wages, Factors affecting real wages, theory of wages, Difference in wages, methods of wage payment. **Money And Exchange:** Theory of exchange, Barter, stock exchange, Speculation money qualities of a good money, function of a money, classification of money, value of money, index number, appreciation and depreciation of money value, Gresham's Law and its limitations.<br><br>**Taxation And Insurance:** Principle of taxation, characteristics of a good taxation system, kinds of taxes, and their merits and demerits, Vehicle Insurance, Loss Assessment. | **9 Hours** |
| **Module - III**<br><br>**Interest And Depreciation:** Introduction, theory of interest, interest rate, interest from lender's and borrower's view point, simple and compound interest. Nominal and effective interest rates, interest formulae Annual compounding, Annual payments and continuous compounding annual payment, simple numerical problems. Need for depreciation causes of depreciation life and salvage value methods of depreciation, simple numerical problems. | **8 Hours** |

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| **Module - IV**<br><br>**Costs:** Standard costs estimated cost, First cost, Fixed cost, Variable costs, Incremental cost, Differential cost, Sunk and marginal cost, Breakeven and minimum cost analysis, simple numerical problems. COST ACCOUNTING: Introduction, objectives of cost accounting, elements of cost material cost, labour cost, and expenses, allocation of over heads by different methods, simple numerical problems.<br><br>**Basis For Comparison of Alternatives:** present worth methods, capital recovery methods, and rate of return method, simple numerical problems. REPLACEMENT ANALYSIS: Basic reasons for replacement present asset and its replacement, consideration leading to replacement, installation and removal cost. | **8 Hours** |
| **Module -V**<br><br>**Cost Estimation:** Introduction, importance, objectives and functions of estimating, principle factors in estimating, Functions and qualities of an estimator, estimating procedure. Estimation of material cost of overhauling and servicing of automotive components, estimating of different types of repairs, estimating the cost of body building, estimating the cost of overhauling the automotive components like cylinder, valves, valve seats, crankshaft, FIP, Brake drum etc. Estimating the cost of manufacturing of simple automotive components. | **9 Hours** |
| **Question paper pattern:**<br><br>1. Total of Ten Questions with Two questions from each Module to be set covering the | |

entire syllabus.

2. Five full questions are to be answered selecting at least One full question from each Module.

3. Each question should not have more than 3 sub divisions

**Text books:**

1. Engineering Economy - TARACHAND, 2000

2. Engineering Economy - RIGGS J.L., McGraw Hill, 2002

3. Engineering Economy - THUWSEN H.G., PHI, 2002

**Reference Books:**

1. Industrial Engineering and Management - O.P KHANNA, Dhanpat Rai & Sons.

2. Financial Management -I.M PANDAY, Vikas Publishing House

3. Engineering Economy - Paul Deoarmo, Macmillan Pub, Co., 2001

4. Mechanical Estimation and Costing - D. Kannappan

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) | |
|---|---|---|---|

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|---|---|---|
| **19AU633** | **CO1** | Introduction to various economic terms and concepts of demand and supply |
| | **CO2** | Study the basic of wages, taxation and insurance. |
| | **CO3** | Explain the concepts of interest and depreciation |
| | **CO4** | Know the knowledge of costs and accounting and basis for comparison of alternatives. |
| | **CO5** | Discuss the basics of importance of cost estimation and their procedures. |

| Course Title: Mechatronics | | |
|---|---|---|
| **Course Code** | **19AU641** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **03 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module - I**<br><br>**Introduction to Mechatronics Systems:** Measurement and control systems their elements and functions. Microprocessor based controllers.<br><br>**Review of Transducers and Sensors:** Definition and classification of transducers. Definition and classification of sensors. Principle of working and application of light sensors, proximity sensors<br><br>and hall effect sensors. | | **08 Hours** |
| **Module - II**<br><br>**Electrical Actuation System:** Electrical systems ,Brief about Mechanical switches, solid state switches & solenoids, DC Motor, classification, speed control of DC Motors Advantages of DC motor; AC Motor classification, single phase induction motor Variable speed A.C motor, stepper motor, classification, permanent magnet stepper motor | | **08 Hours** |
| **Module - III** | | |

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| **Signal Conditioning:** Introduction, processes in signal conditioning Amplifier, operational amplifier, protection, Filtering, classification of filters, Digital signals Analog to digital conversion Digital to analog conversion, concept of DAQ<br><br>and D S P. | **08 Hours** |
| **Module - IV**<br><br>**Introduction to Microprocessor:** Evolution of microprocessor, organization of microprocessor (preliminary concepts), basic concepts of programming of microprocessor. Digital control, Digital control application. Number system Decimal, Binary number system, Logic<br><br>functions.<br><br>**Microprocessor :** Introduction, Arithmetic logic unit, Timing & control unit, Accumulator and general purpose registers Microprocessor, data bus, Address bus, control bus Microprocessor Architecture (Intel 8085A) Pin configuration of INTEL 8085A Microprocessor. | **09 Hours** |
| **Module - V**<br><br>**Organization and Programming of Microprocessor :**<br><br>Introduction set of INTEL8085up, Addressing Modes of INTEL 8085, Instruction word size programming the 8085, Machine language, Assembly Language, Assembler.<br><br>**Micro Controller:** Introduction, Block diagram of a microprocessor, classification of microcontroller INTEL 8051 Microcontroller, Difference | |

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| between Microprocessor & Microcontroller. Difference between RISC & CISC | **09 Hours** |

**Question Paper Pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

**Text books:**

1. Mechatronics —W.Bolton, Longnan. 2Ed, Pearson Publications 2007

2. Microprocessor Architecture, programming & Applications with 8085/ 8085A —

R.S.Goankar, Wiley Eastern

**Reference Books:**

1. Mechatronics —Principles , concept and applications Nitaigour and

Premchand Mahlik —Tata Mc Graw Hill —2003

2. Mechatronics —H.D.Ramachandra rao Sudha Publication.Intel

3. Microprocessor :Barry .B.Brey. Pearson Education

**E books and online course materials:**

**Course outcomes:**

| On completion of the course, the student will have the ability to: | | |
|---|---|---|
| **Course Code** | **CO #** | **Course Outcome (CO)** |
| **19AU641** | **CO1** | Describe the concepts of measurement systems, Transducers and sensors. |
| | **CO2** | Have basic knowledge of Electric system and analyze electric system. |
| | **CO3** | Understand the concepts of signal conditioning. |
| | **CO4** | Have the knowledge of Microprocessor and its concepts. |
| | **CO5** | Discuss the programming concepts of Microprocessor and Microcontroller. |

| **Course Title: Statistical Quality Control** | | |
|---|---|---|
| **Course Code** | **19AU642** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module -I**<br><br>**Introduction:** The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management | | **9 Hours** |

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| (quality philosophy, links between quality and productivity, quality costs legal aspects of quality implementing quality improvement).<br><br>**Modeling Process Quality:** Mean, Median, Mode, Standard deviation, Calculating area, The Deming funnel experiment, Normal distribution tables, finding the Z score, Central limit theorem. | |
| **Module - II**<br><br>**Methods And Philosophy of Statistical Process Control:** Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL). | **9 Hours** |
| **Module - III**<br><br>**Control Charts For Variables:** Control Charts for XBar and R charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems.<br><br>**Process Capability:** The foundation of process capability, Natural Tolerance limits, cp – process capability index, cpk, pp – process performance index, summary of process measures. Numerical problems.abnormal combustion. Development of combustion chambers in SI Engines, requirements of SI Engine combustion chambers, types of combustion chamber. | **8 Hours** |

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| **Module - IV**<br><br>**Control Charts For Attributes:** Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming, Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems.<br><br>**Lot-By-Lot Acceptance Sampling For Attributes:** The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and sequential sampling, AOQL, LTPD, OC curves, Military Standard 105E, the Dodge-Romig Sampling plans. Numerical problems. | **9 Hours** |
| **Module - V**<br><br>**Cumulative-Sum (CUSUM) & Exponentially weighted Moving Average (EWMA) Control Charts:** CUSUM Control Chart (basic principles of the chart for monitoring the process mean); EWMA control chart (EWMA control chart for monitoring process mean), design of an EWMA control chart. | **8 Hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

**Text books:**

1. Statistical Quality Control - E.L. Grant and R.S. Leavenworth, 7th edition, McGraw-Hill publisher.
2. Statistical Quality Control - RC Gupta, Khanna Publishers, New Delhi, 2005

**Reference Books:**

1. Statistical Process Control and Quality Improvement - Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
2. Statistical Quality Control for Manufacturing Managers - W S Messina, Wiley & Sons, Inc. New York, 1987
3. Statistical Quality Control - Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ (ISBN 0-471-65631-3).
4. Principles of Quality Control - Jerry Banks, Wiley & Sons, Inc. New York.

**E books and online course materials:**

| **Course outcomes:**<br>**On completion of the course, the student will have the ability to:** | | |
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| **Course Code** | **CO #** | **Course Outcome (CO)** |
| **19AU642** | **CO1** | Students will gain the knowledge of quality concepts and basics of statistics. |
| | **CO2** | Prepare graphical presentation using quality control techniques |
| | **CO3** | Analyse control charts and sampling plans |
| | **CO4** | Analyse quality circles and ISO quality systems in process control |
| | **CO5** | Analyse reliability of the systems |

| **Course Title: Autotronics** | | |
|---|---|---|
| **CourseCode** | **19AU643** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 hrs. (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module -I**<br><br>**Fundamental Of Automotive Electronics:** Current trends in modern Automobiles, Open loop and closed loop systems - Components for electronic engine management. Electronic | | **8 Hours** |

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| management of chassis system - Vehicle motion control.. | |
| **Module - II**<br><br>**Sensors And Actuators:** Introduction, basic sensor arrangement, types of sensors such as - oxygen sensors, Crank angle position sensors –Fuel metering / vehicle speed sensor and detonation sensor – Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays. | **9 Hours** |
| **Module - III**<br><br>**Electromagnetic Interference Suppression:** Electromagnetic compatibility - Electronic dash board instruments - Onboard diagnosis system. Security and warning system. | **8 Hours** |
| **Module - IV**<br><br>**Electronic Fuel Injection And Ignition Systems:**Introduction, Feed back carburetor systems (FBC) Throttle body injection and multi port or point fuel injection, Fuel injection systems, injection system controls. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contact less electronic ignition system, Electronic spark timing control. | **9 Hours** |
| **MODULE -V**<br><br>**Digital Engine Control System:** Open loop and closed loop control systems - Engine cranking and warm up control - Acceleration enrichment –Deceleration leaning and idle speed control. Distributor less ignition – Integrated engine control system, Exhaust emission | **8 Hours** |

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| control engineering. | |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

**Text books:**

1. William B.Riddens, " Understanding Automotive Electronics ", 5th Edition, Butterworth, Heinemann Woburn, 1998.

2. Tom Weather Jr and Cland C.Hunter, " Automotive Computers and Control System ". Prentice Hall Inc., New Jersey.

**Reference Books:**

1. Young. A.P. and Griffths.L. " Automobile Electrical Equipment ", English Language Book Society and New Press.

2. Crouse. W.H., " Automobile Electrical equipment ", McGraw Hill Book Co Inc., New York, 1955.

3. Robert N Brady, " Automotive Computers and Digital Instrumentation ". A reston Book. Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.

4. Bechtold., " Understanding Automotive Electronic ", SAE, 1998.

5. T.Mellard, " Automotive Electronics

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 19AU643 | CO1 | Describe the concepts of fundamentals of automotive electronics |
| | CO2 | Study the basic knowledge of sensors and transducers. |
| | CO3 | Explain the concepts of electromagnetic interference suppression. |
| | CO4 | Know the knowledge of electronic fuel injection and ignition systems |
| | CO5 | Discuss the programming concepts of digital engine control system. |

| Course Title: Biomass and Bio-Energy | | |
|---|---|---|
| **Course Code** | **19AU6OE** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **3 hrs. (Theory)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **42** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| **Module –I**<br><br>Biomass resources and biomass properties – biomass – definition – classification – availability –estimation of availability, consumption and surplus biomass – energy plantations. Proximate analysis, Ultimate analysis, thermo gravimetric analysis and summative analysis of biomass – briquetting | | **8 Hours** |
| **Module – II**<br><br>Biomass pyrolysis – pyrolysis – types. Production of pyrolytic – oil,char and gases. Effects of particle size, temperature and residence time of pyrolysis on the yield of products. Applications of pyrolytic products. | | **9 Hours** |
| **Module – III**<br><br>. Biodegradation and biodegradability of substrate. Biochemistry and process parameters of biomethanation. Biogas digester types. Digester design and biogas utilization. Economics of biogas plant | | **8 Hours** |

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| with their environmental and social impacts. Bioconversion of substrates into alcohol: Methanol & ethanol Production, organic acids, solvents, amino acids, antibiotics etc | |
| **Module – IV**<br><br>Biomass gasification – gasifiers – fixed bed system – downdraft and updraft gasifiers – fluidized bed gasifiers – design, construction and operation – gasifier burner arrangement for thermal heating – gasifier engine arrangement and electrical power – equilibrium and kinetic consideration in gasifier operation | **9 Hours** |
| **Module – IV**<br><br>ntroduction to Energy from waste – classification of waste as fuel – agro based, forest residue, industrial waste, MSW. Hydrolysis & hydrogenation; Solvent extraction of hydrocarbons; Solvolysis of wood; Biocrude and biodiesel; Chemicals from biomass. | **8 Hours** |

**Question paper pattern:**

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each module
3. Each question should not have more than 3 sub divisions

**Text books:**

1. Desai, Ashok V., Non Conventional Energy, Wiley Eastern Ltd., 1990.
2. C. Y. WereKo-Brobby and E. B. Hagan, Biomass Conversion and Technology, John Wiley & Sons, 1996.

**Reference Books:**

1. Khandelwal, K. C. and Mahdi, S. S., Biogas Technology – A Practical Hand Book – Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
2. Challal, D. S., Food, Feed and Fuel from Biomass, IBH Publishing Co. Pvt. Ltd., 1991
3. Chakraverthy A, "Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes", Oxford & IBH publishing Co, 1989
4. D. Yogi Goswami, Frank Kreith, Jan. F .Kreider, "Principles of Solar Engineering", 2nd Edition, Taylor & Francis, 2000, Indian reprint, 2003[chapter 10]

**E books and online course materials:**

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|

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| **19AU6OE** | **CO1** | Describe about biomass and energy plantation. Analyze physical and chemical properties of biomass through proximate and ultimate analysis |
| | **CO2** | Explain the types of pyrolsis process, effect of various operating parameters on the yield of Bio-oil and also the application of pyrolysis products. |
| | **CO3** | Know about biodegradation and biodegradability of substrate, Biogas digester types, digester design and biogas utilization Bioconversion of substrates into useful products. |
| | **CO4** | Explain constructional and working principle of different types of gasifiers. |
| | **CO5** | Understand the handling of various biomass waste and municipal solid wastes and preparation of chemicals from biomass. |

| Course Title: Automobile Engineering Lab -I | | |
|---|---|---|
| **Course Code** | **19AUL61** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **2 (Practical)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **28** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| 1.Study and layout of an automobile repair, service and maintenance workshops and preparation of Different statements/records required for the repair and maintenance works<br>3.Study of different types of tools and instruments required – sketching , material and their application.<br>3. Dismantling and assembly of engines (SI and CI), identification of major components, and inspection of different components for wear, cracks, measurement and comparison of dimensions of major components with standard.<br>4. Comparative Study of technical specification of two wheeled and four wheeled vehicles (at least 10 vehicles) and Drawing the layouts of chassis frames of cars, bus (front engine & rear engine), truck and articulated vehicles. | | |

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| 5. Disassembling, cleaning, inspection for wear and tear, servicing and assembling of<br>i. Single plate clutch and multi plate clutch. Checking the clutch springs and Clutch adjustments.<br>ii. Different types of gear box and calculation of gear ratios.<br>iii. Propeller shaft assembly including universal joint , slip joint final drive and differential.<br>iv. Steering system and steering gears.<br>v. Braking system, bleeding in hydraulic brakes<br>vi. Front independent suspension, shock absorber and leaf spring suspension system. | **28 hours** |

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AUL61** | **CO1** | Plan workshop layouts, prepare documents required in service station/workshops |
| | **CO2** | Identify and select the specific tools used for servicing of components & systems. |
| | **CO3** | Dismantle and assemble an engine, indentify and inspect major components |
| | **CO4** | Compare the two wheeler and four wheeler vehicles technical |

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| | | specifications |
| | **CO5** | Demonstrate the skills in fault diagnosis and devise proper servicing schedules for chassis components and systems. |

| **Course Title: Automobile Engineering Lab -II** | | |
|---|---|---|
| **Course Code** | **19AUL62** | **CIE: 50** |
| **Number of Lecture Hours/Week** | **2 (Practical)** | **SEE: 50** |
| **Total Number of Lecture Hours** | **28** | **SEE Hours: 03** |
| **Modules** | | **Teaching Hours** |
| 1. Identification of location of following components in a vehicle and note their functions along with dismantling & assembly and inspection of :<br>3.Carburetors, Fuel injection pumps, Injectors, Fuel filters, Fuel pumps<br>3. Study of CRDI system and Turbo-chargers<br>4.Cooling systems and Lubricating systems.<br>5.Testing and servicing of automotive batteries, starter motor , | | |

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| alternators, regulators and cut outs.<br>6.Fault diagnosis in electrical ignition system in gasoline fuel system, diesel fuel system and rectification<br>7.Study of faults in electrical systems such as head lights, side and parking lights, trafficator lights, electric horn system, windscreen wiper system, charging system and adjustment of head light beam.<br>8.Study of traffic regulations and driving practice. | **28 hours** |

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **19AUL62** | **CO1** | Dismantle, assemble, inspect the fuel supply components in an vehicle |
| | **CO2** | Inspect and service cooling and lubricating systems |
| | **CO3** | Do servicing and testing of automotive batteries, starter motor , alternators, regulators and cut outs. |
| | **CO4** | Know the fault finding and rectification of ignition circuits, and other electrical systems |
| | **CO5** | Explain the traffic rules as per M.V. Act 1988 and demonstrate driving a four wheeled vehicle |