Scheme of Examination
and
Syllabus

for

Master of Vocation

in

Automobile Technology

offered by

University School of Information, Communication and Technology

Guru Gobind Singh Indrapastha University
Sector-16 C, Dwarka, New Delhi - 110 078
www.ipu.ac.in

(Prof. JP Gupta)
Ext. Expert

University School of Information, Communication & Technology
Guru Gobind Singh Indraprastha University, Dwarka, Delhi

Programme: Master of Vocation (Automobile Technology)
First Semester Examination

Course Code	Paper ID	Course Title	L	T	P	Credits
Theory Paper(s)						
MVOCAT-101		Automotive Engines and Subsystems	3	0	0	3
MVOCAT-103		Automotive Transmission System	3	0	0	3
MVOCAT-105		Automotive Pollution and Control	3	0	0	3
MVOCAT-107		Manufacturing of Automobile Components	3	0	0	3
MVOCAT-109		Human Resource Management	3	0	0	3
Practical(s)						
MVOCAT-151		Automotive Engines and Subsystems Lab	0	0	4	2
MVOCAT-153		Automotive Transmission System Lab	0	0	4	2
MVOCAT-155		Automotive Pollution and Control Lab	0	0	4	2
MVOCAT-157		Manufacturing of Automobile Components Lab	0	0	4	2
		Total				23

Scheme and Syllabus of M.Voc in Automobile Technology is approved in 49th BoS of USIC&T on 27th Feb. 2019. This scheme is effective from Academic Session 2019-20 onwards.

University School of Information, Communication & Technology
Guru Gobind Singh Indraprastha University, Dwarka, Delhi

Programme: Master of Vocation (Automobile Technology)
Second Semester Examination

Course Code	Paper ID	Course Title	L	T	P	Credits
Theory Paper(s)						
MVOCAT-102		Automotive Electrical and Electronics	3	0	0	3
MVOCAT-104		Engine Management Systems	3	0	0	3
MVOCAT-106		Automotive Materials	3	0	0	3
MVOCAT-108*		Self-Study-1	3	0	0	3
Elective (Choose any one)						
MVOCAT-110		Vehicle Dynamics and Control	3	0	0	3
MVOCAT-112		Special Type of Vehicles	3	0	0	3
MVOCAT-114		Modern Vehicle Technology	3	0	0	3
MVOCAT-116		Composite Materials and Structures	3	0	0	3
Practical(s)						
MVOCAT-152		Automotive Electrical and Electronics Lab	0	0	4	2
MVOCAT-154		Computer Aided Vehicle Design Lab	0	0	4	2
MVOCAT-156		Engine Management Systems Lab	0	0	4	2
MVOCAT-158		Automotive Materials Lab	0	0	4	2
		Total				23

*NUES course: Principal of college shall ensure that student should register in NPTEL/SWAYAM/MOOC course and award marks based on certificate issued by respective institution.

Scheme and Syllabus of M.Voc in Automobile Technology is approved in BoS of USIC&T on 27th August, 2018.

University School of Information, Communication & Technology
Guru Gobind Singh Indraprastha University, Dwarka, Delhi

Programme: Master of Vocation (Automobile Technology)
Third Semester Examination

Course Code	Paper ID	Course Title	L	T	P	Credits
Theory Paper(s)						
MVOCAT-201		Automotive Air conditioning Systems	3	0	0	3
MVOCAT-203*		Self Study-2	3	0	0	3
Electives(Choose Any Two)						
MVOCAT-205		Alternative Fuels and Energy System	3	0	0	3
MVOCAT-207		Research Methodology and Development Communication	3	0	0	3
MVOCAT-209		Concept of Entrepreneurship	3	0	0	3
MVOCAT-211		Marketing Management	3	0	0	3
MVOCAT-213		MIS and ERP	3	0	0	3
Practical(s)						
MVOCAT-251		Automotive Air conditioning Systems Lab	0	0	8	4
MVOCAT-253		Minor Project	0	0	12	6
MVOCAT-255#		Industrial Training	0	0	4	2
		Total				24

*NUES course: Principal of college shall ensure that student should register in NPTEL/SWAYAM/MOOC course and award marks based on certificate issued by respective institution.

Training of MVOCAT-255 should be completed during summer vacation after 2nd semester and report should be prepared. Viva-voce of this course shall be conducted in 3rd semester by University Examination Division.

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University School of Information, Communication & Technology
Guru Gobind Singh Indraprastha University, Dwarka, Delhi

Programme: Master of Vocation (Automobile Technology)
Fourth Semester Examination

Course Code	Paper ID	Course Title	L	T	P	Credits
Practical(s)						
MVOCAT-252		Major Project	0	0	52	26
MVOCAT-254		Seminar and Progress Report	0	0	8	4
		Total				30

Note:

1. Total number of Credits of the Programme M.Voc=100
2. Each student shall be required to appear for examination in all papers of Course, but for the award of the Degree, a student shall be required to earn a minimum of 94 credits out of 100. Relaxation of 6 credit papers of the course is restricted to only elective papers.
3. M.Voc programme shall be governed as per Ordinance-11 of GGSIPU.
4. The minimum passing marks for all papers of the course shall be 40.

AUTOMOTIVE ENGINES AND SUBSYSTEMS

Paper Code: **MVOCAT-101**
Paper: **Automotive Engines and Subsystems**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I ENGINE BASIC THEORY

Engine types – Otto, diesel, dual operating cycles – Fuel - Air Cycle - Engine design and operating parameters - Two and four stroke engines - Typical performance curves for automobile engines- two stroke engine - performance and pollution aspects.
Advances in Engine Technology: Lean Burn engine – Different approaches to lean bum – LHR engine – Surface ignition concept – catalytic ignition – homogenous charge compression ignition – Stratified charge engines – VCR Engines - variable valve timing – Multi Port Injection System - Gasoline Direct Injection – Common Rail Direct Injection – Recent Trends.

UNIT II FUEL SUPPLY AND IGNITION SYSTEMS

Theory of carburetion- carburetors-types and their working, Design aspects of Carburetors – diesel fuel injection- pumps, governors and injectors, conventional and electronic ignition systems, advance mechanisms- fuel line hydraulics.

UNIT III COOLING AND LUBRICATING SYSTEMS

Air cooling and water cooling – thermo syphon cooling, forced cooling systems. Fins and radiator - design aspects – properties of coolants Theory of lubrication — types of lubrication, splash lubrication system, Petroil lubrication system, forced feed lubrication system - properties of lubricants – Additives used in lubricants.

UNIT IV AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS

Importance of swirl, squish and turbulence - Combustion in SI and CI engines - Premixed combustion, diffused combustion - laminar and turbulent combustion of fuels in engines - Droplet combustion – Cylinder pressure data and heat release analysis.
Optimized design of combustion chambers- Supercharger and Turbochargers – VGT

TEXT BOOKS:

T[1].V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Fourth Edition, 2012.

T[2].M. L. Mathur, R. P. Sharma, "Internal combustion engines", Dhanpat Rai Publication, 2005.

T[3].J.B.Heywood, 'Internal combustion engine Fundamentals', McGraw Hill Book Co, 1989.

REFERENCE BOOKS:

R[1].William Crouse, Donald Anglin, "AUTOMOTIVE MECHANICS", Tata McGraw Hill Book Co, 2006.

R[2].G. S. Springer and A. J. Patterson, 'Engine emissions and pollutant formation', plenum press, New York, 1985.

R[3].Heinz Heisler, Advanced Engine Technology, SAE publication, 1995.

AUTOMOTIVE TRANSMISSION SYSTEM

Paper Code: **MVOCAT-103**
Paper: **Automotive Transmission System**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS — **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I CLUTCH AND HYDROSTATIC DRIVE

Requirements of Transmission system, Clutches – Functions, Principle of operation and types – single plate, multi plate, diaphragm, centrifugal and overrunning clutches.
Hydrostatic drive – various types of hydrostatic transmission – principle - Advantages and limitations. Comparison of hydrostatic transmission with hydrodynamic transmission. Construction and working principle of Janny hydrostatic drive.

UNIT II GEAR BOX AND ELECTRIC DRIVE

Purpose of gear box, Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications
Electric drive- Principle of Early and modified Ward Leonard control system – advantages and limitations.

UNIT III HYDRODYNAMIC TRANSMISSION

Fluid coupling – principles - Performance characteristics – advantages – limitations – drag torque – reduction of drag torque. Torque converter - principles - Performance characteristics – advantages – limitations – multi and poly stage torque converters.

UNIT IV AUTOMATIC TRANSMISSION

Introduction to epicycle gear trains - Ford – T model gear box, Wilson gear box- Cotal electric transmission. Chevrolet "Turboglide" transmission. – Hydraulic control systems of automatic transmission. Continuously Variable Transmission (CVT) – types – Operations.

TEXT BOOKS:

T[1].Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005.
T[2].Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002.
T[3].James Larminie "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
T[4].Judge.A.W. Modern Transmission systems, Chapman and Hall Ltd, 2000.

Scheme and Syllabus of M.Voc in Automobile Technology is approved in BoS of USIC&T on 27th August, 2018.

REFERENCE BOOKS:

R[1].T. Kenneth Garrett, Kenneth Newton and William Steeds, "The Motor Vehicle" 13th Edition, Butterworth-Heinemann Limited, London, 2005.

R[2].Jack Erkavec "Automotive Engineering – Automatic Transmission & Transaxles"Classroom and shop Manual, Cengage Learning India Pvt Ltd., 2011.

R[3].Jack Erkavec "Automotive Technology- Manual Transmission", Centage Learning India Pvt Ltd., 2011.

R[4].Heldt P.M, Torque Converters, Chilton Book Co., 1992.

AUTOMOTIVE POLLUTION AND CONTROL

Paper Code: **MVOCAT-105** | L T/P C

Paper: **Automotive Pollution and Control** | 3 0 3

INSTRUCTION TO PAPER SETTERS — **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I EMISSION FROM AUTOMOBILES

Sources of Air Pollution, Various emissions from Automobiles — Effects of pollutants on environment and human beings – global warming-Acid Rain - National and International Emission standards. Automotive waste management - Recycling and End of Life Vehicle (ELV) - Recycling of Metals, Nonmetals, tyres and wiring harness and disposal of hazardous materials.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL

Emission formation in SI Engines – Carbon monoxide & Carbon di oxide – Unburned hydrocarbon, NOx, P M – Effects of design and operating variables on emission formation– controlling of pollutants – fuel modifications - Positive Crank case ventilation system, Evaporative Emission Control, Exhaust Gas Recirculation, Secondary air injection, thermal reactor, Catalytic converters – Types – substrate, Wash coat and Catalyst, Cold start emission control – Close coupled catalytic converter, Hydrocarbon Adsorber- Leam de-NOx Catalysts-NOx traps – Catalyst deactivation.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL

Formation of White, Blue, and Black Smokes, Soot, Particulate Matter NOx, SOx, HC, CO and Intermediate Compounds – Significance Effect of design and Operating variables on Emission formation —Fuel modification/additives, CRDI - High Injection Pressure and Injection Rate Shaping and Multiple injection, EGR- EGR Cooling and Heating, EGR Control, Fumigation, Diesel Oxydation Catalysts, Diesel de-NOx Catalysts, NOx traps, SCR, Diesel Particulate Filters - DPF material, structure and regeneration- HCCI Engines.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES

Sources of Noise- Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise and Exhaust Noise. Noise reduction in Automobiles - Encapsulation technique for noise reduction, Silencer Design.

Test Procedures and Emission Measurements: Test cycles for light and medium duty vehicles – US-EPA cycle, ECE and EUDC cycle, Japanese cycle, Indian driving cycles – steady state and transient cycles - SHED Test - Chassis dynamometer – Constant Volume Sampling (CVS) Procedure for driving cycles - Emission analyzers — NDIR, FID, Chemiluminesecent

Analyzer (CLA), Smoke meters, Gas Chromatography, Particulate Emission Measurement - Dilution Tunnel, Sound level meters.

TEXT BOOKS:

T[1].B.P. Pundir, "Engine Emissions-Pollutant Formation and Advances in Control Technology" Narosa Publishing house Pvt. Ltd, 2011.

T[2].D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control',Anna Arbor Science Publication,1985.

T[3].G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.

T[4].Geoff Davies, "Materials for Automobile Bodies", Butterworth-Heinemann, 2012.

REFERENCE BOOKS:

R[1].Bernard Challen and Rodica Baranescu, "Diesel Engine Reference Book" – Second edition – SAE International Publications– 1999.

R[2].Eran Sher "Handbook of Air Pollution from Internal Combustion Engines- Pollutant Formation and Control" ACADEMIC PRESS, 1998.

R[3].Matthew Harrison, "Vehicle refinement: controlling noise and vibration in road vehicles", Elsevier, Indian Edition, 2011.

R[4].Paul Degobert, "Automobiles and Pollution" SAE Publications, 1991.

MANUFACTURING OF AUTOMOBILE COMPONENTS

Paper Code: **MVOCAT-107** L T/P C

Paper: **Manufacturing of Automobile Components** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I CASTING

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts. Melting practice of alloys.
Recent Trends In Manufacturing Of Auto Components: Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors. Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts.

UNIT II MACHINING

Special consideration of machining of various components such as flywheel, piston rings, bearing bushes, and liners. Machining of connecting rods - crank shaft - cam shaft - piston - piston pin – valve - front and rear axle housing - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

UNIT III FORGING, EXTRUSION AND FORMING PROCESS

Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing – forming of wheel disc and rims. Stretch forming - Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

UNIT IV POWDER METALLURGY AND PROCESSING OF PLASTICS

Powder metallurgy process, process variables, Manufacture of friction lining materials for clutches and brakes – plastics-raw material –automobile components – molding – injection, compression and blow – PU foam molding - Machining of plastics. Tyre manufacturing, Recycling of tyres.

TEXT BOOKS:

T[1].Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
T[2].Heldt.P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990.

T[3].High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990.
T[4].Rusinoff, " Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.

REFERENCE BOOKS:

R[1].Sabroff.A.M. & Others, "Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.
R[2].Upton, "Pressure Die Casting ", Pergamon Press, 1985.
R[3].HMT handbook.

Paper Code: MVOCAT-109 L T/P C

Paper: Human Resource Management 3 0 3

INSTRUCTION TO PAPER SETTERS	MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Unit I: Human Resource Management

Concept and functions; Role, status and competencies of HR manager; HR policies; Evolution of HRM; Emerging challenges of human resource management - Workforce diversity, empowerment, downsizing, VRS, work life balance.

Maintenance of employees and Emerging Horizons of HRM: Employee health and safety; Employee welfare; Social security (excluding legal provisions); Employer-employee relations- An overview; Grievance handling and redressal; Industrial disputes: Causes and settlement machinery; e-HRM; Human Resource Information System and e-HRM; Impact of HRM practices on organizational performance: HR audit, Contemporary issues in human resource management.

Unit II: Acquisition of Human Resource

Human resource planning- Quantitative and qualitative dimensions; Job analysis - Job description and job specification; Recruitment - concept and sources; Selection - concept and process; Test and interview; Placement, induction and socialization; Retention.

Unit III: Training and Development

Concept and importance; Role specific and competency based training; Training and development methods - Apprenticeship, understudy, job rotation. vestibule training, case study, role playing, sensitivity training, In-basket, management games, conferences and seminars, coaching and mentoring, management development programs; Training process outsourcing.

Unit IV: Performance Appraisal and Compensation Management

Performance appraisal- Nature, objectives and process; Performance management; Methods of performance appraisal; Potential appraisal; Employee counseling; Job changes - Transfers and promotions, Human resource audit;

Compensation - Concept and policies, Base and supplementary compensation; Individual, group and organization incentive plans; Fringe benefits; Performance linked compensation; Employee stock option; Pay band compensation system; Job evaluation.

TEXT BOOKS:

T[1].Mondy, A. W., and Noe, R. M. Human Resource Management. Pearson Education.
T[2].Decenzo, D.A., and Robbins, S. P. Fundamentals of Human Resource Management, Wiley, India.
T[3].Dessler, G., and Varkkey, B. Human Resource Management. Pearson Education, Delhi.

REFERENCE BOOKS:

R[1].Gupta, C.B. Human Resource Management,-Sultan Chand and Sons Delhi

R[2].Chhabra, T.N, Human Resource Management, Dhanapat Rai and Co. Delhi

AUTOMOTIVE ENGINES AND SUBSYSTEMS LAB

Paper Code: **MVOCAT-151** L T/P C

Paper: **Automotive Engines and Subsystems Lab** 0 4 2

***Note:** - The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 10 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1 Study of various types of dynamometers

2 Study of engine emission analyzers and pressure transducers

3 Determination of valve timing of and port timing of an internal combustion engine

4 Determination of frictional power of a multi-cylinder petrol engine using Morse Test.

5 Determination of frictional power of a diesel engine using Willan's line method.

6 Performance, emission & heat balance test on single cylinder constant speed petrol engine.

7 Performance, emission and heat balance test on twin cylinder four stroke constant speed diesel engine.

8 Performance study of variable speed multi-cylinder petrol engine.

9 Performance study on variable compression ratio engine.

10 Evaluate combustion characteristics of a constant speed diesel engine.

11 Evaluate combustion characteristics of a constant speed petrol engine.

Paper Code: **MVOCAT-153**
Paper: **Automotive Transmission system Lab**

L	T/P	C
0	4	2

***Note:** - The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 10 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Study of chassis system and Chassis dynamometer.
2. Study, Dismantling and Assembling of the following.
3. Study, Dismantling and Assembling of Single plate, Diaphragm Clutch.
4. Study, Dismantling and Assembling of Sliding mesh and Constant mesh gear box.
5. Study, Dismantling and Assembling of Synchromesh-Four speed range.
6. Study, Dismantling and Assembling of Four wheel Drive and Transfer case.
7. Study, Dismantling and Assembling of a Differential unit.
8. Study, Dismantling and Assembling of a Propeller shaft unit.
9. Study, Dismantling and Assembling of Front axle, Rear axle.
10. Study, Dismantling and Assembling of Disc and Drum brake.
11. Study, Dismantling and Assembling of Steering gear box.

Paper Code: **MVOCAT-155** | L T/P C
Paper: **Automotive Pollution and Control Lab** | 0 4 2

Note: *- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 10 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Study the Various emissions from Automobiles
2. Study of NDIR Gas Analyser and FID
3. Study of Chemiluminescent NOx analyzer
4. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer
5. Diesel smoke measurement.
6. Study of ECE and EUDC cycle
7. Study of Chassis dynamometer
8. Study of Constant Volume Sampling (CVS) Procedure for driving cycles
9. Study of Smoke meters,
10. Study of Gas Chromatography,
11. Study of Particulate Emission Measurement
12. Study of Dilution Tunnel and Sound level meters.

REFERENCE BOOKS:

R[1].Crouse. W.H. and Anglin. D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
R[2].Ganesan. V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
R[3].BIS code Books, IS-10000 series, 1988.

MANUFACTURING OF AUTOMOBILE COMPONENTS LAB

Paper Code: MVOCAT-157 | L T/P C
Paper: **Manufacturing of Automobile Components Lab** | 0 4 2

Note: *- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 10 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Machining of flywheel.
2. Machining of bearing bushes, and liners.
3. Machining of connecting rods
4. Machining of crank shaft and cam shaft.
5. Machining of piston, piston rings and piston pin,
6. Machining of valve.
7. Machining of front and rear axle housing.
8. Honing of cylinder bores.
9. Study of Copy turning and profile grinding machines.
10. Stretch forming of auto body panels
11. Collaboration with CAPIER, Mechanical Engg. Department, DTU, New Delhi.
12. Industrial visit for Powder Metallurgy and Processing of Automobile Components.

SYLLABUS

Master of Vocation (Automobile Technology)

SECOND SEMESTER

AUTOMOTIVE ELECTRICAL AND ELECTRONICS

Paper Code: **MVOCAT-102** L T/P C

Paper: **Automotive Electrical And Electronics** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I BATTERIES AND ACCESSORIES

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods - Horn, wiper system and trafficator.

UNIT II STARTING SYSTEM

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, start stop system, working of different starter drive units, care and maintenances of starter motor, starter switches.
Sensors and Actuators: Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application, rail pressure, cam position. Solenoids, stepper motors, relay. Sensors for intelligent transport systems. Lighting, wipers, climate control and electronic displays. Sensors for occupant safety .The digital vehicle. Intelligent vehicle systems

UNIT III CHARGING SYSTEM

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments, wiring requirements, insulated and earth return systems.

UNIT IV FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard

instruments, onboard diagnostic system, OBD I, II, security and warning system. Electronic ignition and injection systems.

TEXT BOOKS:

T[1].Young A.P. & Griffiths. L."Automotive Electrical Equipment", ELBS & New Press-1999.

T[2].William B. Riddens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.

T[3].Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.

REFERENCES BOOKS:

R[1].Bechhold "Understanding Automotive Electronics", SAE, 1998.

R[2].Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.

R[3].Kholi. P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.

R[4].Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.

R[5].Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

ENGINE MANAGEMENT SYSTEMS

Paper Code: **MVOCAT-104**

Paper: **Engine Management Systems**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II SENSORS AND ACTUATORS

Inductive, Hall Effect, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine speed sensor, exhaust oxygen level (two step, linear lambda and wideband), knock, manifold temperature and pressure sensors. Solenoid, relay (four and five pin), stepper motor.

UNIT III SI ENGINE MANAGEMENT

Layout and working of SI engine management systems. Group and sequential injection techniques. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless (BREAKERLESS) electronic ignition system, Electronic spark timing control.

UNIT IV CI ENGINE MANAGEMENT

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Electronically controlled Unit Injection system. Common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

Digital Engine Control System: Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop and closed loop control – Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TEXT BOOKS:

T[1].Allan Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, Elsevier, Indian Edition, 2011.

T[2].Eric Chowanietz, "Automobile Electronics" by SAE Publications, 1995.

T[3].Tom Denton, "Advanced Automotive Fault Diagnosis", Butterworth-Heinemann, Elsevier, Indian Edition, 2011.
T[4].William B. Ribbens, Norman P. Mansour,"Understanding automotive electronics", Newnes, Elsevier, Indian Edition, 2011.

REFERENCE BOOKS:

R[1].Julian Happian, Smith, 'An Introduction to modern vehicle Design', Butterworth-Heinemann, 2002.
R[2].Robert Bosch, "Diesel Engine Management", SAE Publications 2004.
R[3].Robert Bosch, "Gasoline Engine Management", SAE Publications 2004.
R[4].Steve V. Hatch, "Electronic Engine controls", Cengage Learning India Pvt Ltd., 2009

AUTOMOTIVE MATERIALS

Paper Code: **MVOCAT-106** | L T/P C

Paper: **Automotive Materials** | 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Unit 1 Review of Mechanical and Chemical behavior of Materials

Structure of crystalline solids, imperfections in solids, Plastic deformation - Strengthening mechanisms - Griffith's theory of failure modes - Damping properties of materials - fracture toughness - Initiation and propagation of fatigue cracks - Creep mechanisms environmentally induced degradation and preventive solutions

Unit 2 Automotive Components & Material Selection

Organized process of selection of materials for different components. Materials for Power train components like cylinder block ,head& liner, piston &piston rings, gudgeon pin, connecting rod, bearings, crankshaft, flywheel, camshaft, valves, valves seats, springs, gear train, chain &belt drives. Materials for Automobile components like body –in –white, crash worthiness, suspension systems, cabin interiors. Functional requirements, manufacturing processes failure modes for each.

Unit 3 Engineering Alloys

Cast iron, steels, alloy steels - significance of iron – iron carbide equilibrium diagram in design steels and cast irons, stainless steels –, types, specific applications, heat treatment, effect of alloying elements Aluminum, Magnesium and Ti wrought and cast alloys used in automotive applications –Types, specifications, heat treatment

Non Metallic materials: Elastomers and Engineering Plastics, FRP Composite materials, ceramics, laminated &heat treated glass, adhesive bonding, An over view of Manufacturing processing, their characteristics features, types and applications.

Unit 4 Surface Modification of Materials

Mechanical surface treatment and coating - Case hardening and hard facing - thermal spraying – vapour deposition-iron implantation - Diffusion coating - Electroplating and Electro-less - Conversion coating - Ceramic and organic coatings – laser based surface modification Diamond coating.

Modern Materials and Alloys: Light weight materials & implications on vehicle design,, Micro alloyed, high strength low alloy steel - High strength Steels (HSS), Advanced High Strength Steels (AHSS), Ultra high strength Steels (UHSS), developments in Aluminum and Magnesium alloys, Advanced forming & joining processes like - Hydro forming, Warm forming, Laser welding techniques, Induction heating, etc; carbon fiber composites, Natural fibers, refractory metals,

SMART Materials - shape memory alloys (SMA), Piezo-electric materials, MEMS, Metallic glass-Quasi crystal and Nano crystalline materials, metal foams.

TEXT BOOKS:

T[1].Callister W.D. (2006) "Material Science and Engineering- An introduction", Wiley – Eastern can be indicated as a text book.

T[2].Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 9th Edition 2009, can be included as a text book.

REFERENCE BOOKS:

R[1].Hiroshi Yamagata "The Science and Technology of Materials in Automotive Engines"

R[2].Thomas H. Courtney, (2000) "Mechanical Behavior of Materials", McGraw Hill.

R[3].Flinn R. A. and Trojan P. K., (1999)"Engineering Materials and their Applications", Jaico.

R[4].KENNETH BUDINSKI – (1988) "Surface Engineering for wear resistance", Prentice Hall.

R[5].Avner S.H., (2006) "Introduction to physical metallurgy" –Tata McGraw Hill.

R[6].Ashby & Jones, "Engineering Materials 1 - An introduction to their Properties and Applications".

R[7].Ashby and Jones, "Engineering Materials 2 - An Introduction to Microstructures, Processing and Design".

R[8].LC Brinson, "Polymer Engineering Science and Viscoelasticity".

R[9].Paul Hiemenz, "Polymer Chemistry-The Basic Concepts".

R[10].Deborah Chung, "Composite Materials - Science & Applications".

VEHICLE DYNAMICS AND CONTROL

Paper Code: **MVOCAT-110** L T/P C

Paper: **Vehicle Dynamics and Control** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I VEHICLES HANDLING CHARACTERISTICS

Sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

UNIT II STABILITY OF VEHICLES AND SUSPENTION CONTROL SYSTEM

Load distribution, stability on a curved track, slope and a banked road, calculation of tractive effort and reactions for different drives.
Semi-Active Suspension Model - Performance of Semi-Active Suspension Systems. Active Automotive Suspensions - Hydraulic Actuators for Active Suspensions Analysis of Vibrations in the Sprung Mass Mode and Unsprung Mass Mode - Verification Using Quarter Model Half-Car and Full-Car Suspension Models.

UNIT III LONGITUDINAL AND LATERAL DYNAMICS

Aerodynamic drag force - Longitudinal tire force - Rolling resistance - Calculation of normal tire forces-Lateral Systems - Dynamic Model in Terms of Error with Respect to Road, Yaw Rate and Slip Angle.

UNIT IV DRIVELINE CONTROL SYSTEM

Speed control - cylinder cut - off technology, Gear shifting control - Traction / Braking control, brake by wire - Adaptive cruise control, throttle by wire. Anti-Lock Brake Systems, Steering - Power steering, collapsible and tilt able steering column - steer by wire. Independent All Wheel Drive Torque Distribution

TEXT BOOKS:

T[1].Rajesh Rajamani - Vehicle dynamics and control, Springer 2005.
T[2].Giri N.K - Automotive Mechanics, Khanna Publishers, 2002.
T[3].Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi -2, 2002.

REFERENCE BOOKS:

R[1].Heldt.P.M -"Automotive Chassis"- Chilton Co., New York- 1992.
R[2].Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991.

R[3].Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998.
R[4].Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
R[5].Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.

SPECIAL TYPE OF VEHICLES

Paper Code: **MVOCAT-112** L T/P C

Paper: **Special Type of Vehicles** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS

Construction details, capacity and applications of earthmovers for dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc. criteria for selection of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

UNIT II POWER TRAIN CONCEPTS

Engine – converter match curves. Epicyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

Farm Equipments, Military and Combat Vehicles: Ride and stability characteristics, power take off, special implementations. Special Features and constructional details of tankers, gun carriers and transport vehicles. Harvesting vehicles.

UNIT III VEHICLE SYSTEMS AND FEATURES

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects of dumper body, loader bucket and water tank of sprinkler. Articulated vehicles, double decker. Fire fighting equipment.

UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS

Constructional features, capacity and stability of jib cranes. Vibratory compactors, Stackers, Bore well machines and Concrete mixtures.

TEXT BOOKS:

T[1].Astakhov, 'Truck cranes', MIR Publishers, Moscow, 1971.
T[2].Bart H Vanderveen, 'Tanks and Transport Vehicles', Frederic Warne and co. Ltd., London, 1974.
T[3].Pipenger, 'Industrial Hydralics', Mcgraw Hill, Tokoyo, 1979.

REFERENCE BOOKS:

R[1].SAE Handbook – Vol III, 1995.
R[2].K. Abrosimov, A. Bromberg and F. Katayer, 'Road making machineries', MIR Publisher, Moscow,1975.

MODERN VEHICLE TECHNOLOGY

Paper Code: **MVOCAT-114** L T/P C

Paper: **Modern Vehicle Technology** 3 0 3

INSTRUCTION TO PAPER SETTERS	MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / lean burn engines - Hydrogen engines - Battery vehicles - Electric propulsion with cables - Magnetic track vehicles. Tuned Manifold for Race Cars

UNIT II SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - Antiskid braking system, Retarders, Regenerative braking safety cage - Air bags - Crash resistance - Passenger comfort.

Vehicle Automated Tracks: Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

UNIT III NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels / power plants - Catalytic converters and filters for particulate emission

UNIT IV VEHICLE OPERATION AND CONTROL

Computer control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

TEXT BOOK:

T[1].Heinz Heisler, "Advanced Vehicle Technology" - Arnold Publication.

REFERENCE BOOKS:

R[1].Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 1993.

R[2].Bosch Hand Book, 3rd Edition, SAE, 1993.

COMPOSITE MATERIALS AND STRUCTURES

Paper Code: **MVOCAT-116** L T/P C

Paper: **Composite Materials and Structures** 3 0 3

0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I INTRODUCTION TO COMPOSITES

Fundamentals of composites - Need for composites - Enhancement of properties - Classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) - Reinforcement - Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites

UNIT II POLYMER MATRIX COMPOSITES

Polymer matrix resins - Thermosetting resins, thermoplastic resins - Reinforcement fibres – Rovings Woven fabrics - Non woven random mats - Various types of fibres. PMC processes - Hand lay up processes - Spray up processes - Compression moulding - Reinforced reaction injection moulding - Resin transfer moulding - Pultrusion - Filament winding - Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GFRP).

UNIT III METAL MATRIX COMPOSITES

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements - Particles - Fibres. Effect of reinforcementVolume fraction - Rule of mixtures. Processing of MMC - Powder metallurgy process - Diffusion bonding - Stir casting - Squeeze casting

UNIT IV CERAMIC MATRIX COMPOSITES

Engineering ceramic materials - Properties - Advantages - Limitations - Monolithic ceramics - Need for CMC - Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics - Non oxide ceramics - Aluminium oxide - Silicon nitride - Reinforcements - Particles- Fibres- whiskers. Sintering - Hot pressing - Cold Isostatic Pressing (CIP) - Hot isostatic pressing (HIP). Application and Analysis of Composites: Carbon /carbon composites - Advantages of carbon matrix - limitations of carbon matrix Carbon fibre Chemical vapour deposition of carbon on carbon fibre perform. Sol-gel technique. Composites for aerospace applications. Testing of Composite Materials.

TEXT BOOKS:

T[1].Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 1st edition, 1994.
T[2].Chawla K.K., "Composite materials", Springer - Verlag, 1987.

REFERENCE BOOKS:

R[1].Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
R[2].Strong A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
R[3].Sharma S.C., "Composite materials", Narosa Publications, 2000.
R[4]."Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.

AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB

Paper Code: **MVOCAT-152**	L	T/P	C
Paper: **Automotive Electrical and Electronics Lab**	0	4	2

Note: *- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Testing of
    - Battery
    - starting systems
    - charging systems
    - ignition systems
    - body controller systems
2. Study of automotive lighting system and adjustment of head lights beam
3. Study of various sensors and actuators used in two wheelers and four wheelers for electronic control
4. Study of Logic gates, Adders, Flip flops
5. Study of SCR and IC Timers
6. Interfacing amplifier, filter, Multiplexer and De-multiplexer
7. Interfacing seven segment displays
8. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table
9. Interfacing ADC and DAC for Data Acquisition and Control Application
10. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
11. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
12. Study of Virtual Instrumentation
13. Study of Development of Embedded Systems.

COMPUTER AIDED VEHICLE DESIGN LAB

Paper Code: **MVOCAT-154**

Paper: **Computer Aided Vehicle Design Lab**

L	T/P	C
0	4	2

Note: *- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

Design, Model and (Structural / Thermal) Analysis of the following components

1. Engine Cylinder.
2. Piston Assembly.
3. Connecting rod.
4. Valves.
5. Crank shaft.
6. Cam shaft.
7. Vehicle Frame.
8. Suspension Spring.
9. Front axle.
10. Rear axle.
11. Gear box.

REFERENCE BOOKS:

R[1].AUTO CAD, CATIA and ANSYS software guide / manual

R[2].Dean Averns, "Automobile Chassis Design ", Illiffe Books Ltd, 1992.

R[3].Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers,

R[4].Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.

R[5].Steeds.W., " Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.

R[6].T. Kenneth Garrett, Kenneth Newton and William Steeds, "The Motor Vehicle" 13th Edition, Butterworth-Heinemann Limited, London, 2005.

ENGINE MANAGEMENT SYSTEMS LAB

Paper Code: **MVOCAT-156**	L	T/P	C
Paper: **Engine Management System Lab**	0	4	2

Note: - The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

LIST OF EXPERIMENTS

1. Study of fundamentals of Engine management system
2. Study of The Electronic Control Unit (ECU)
3. Study of Transducer circuits and components
4. Study of Transducer circuits and components – fault diagnosis
5. Study of Actuator circuits and components
6. Study of Actuator circuits and components – fault diagnosis
7. Study of The exhaust system
8. Study of Vehicle emissions
9. Study of Intake air temperature control systems
10. Study of Emission control
11. Study of Air-injection systems
12. Study of EGR systems
13. Study of EVAP systems

AUTOMOTIVE MATERIALS LAB

Paper Code: **MVOCAT-158**

Paper: **Automotive Materials Lab**

L	T/P	C
0	4	2

***Note:** - The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Specimen preparation for metallographic examination /micro structural examination cutting, grinding, polishing and etching.
2. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
3. Study of Microstructure and hardness of steel at different rates of cooling.
4. Study of Microstructure examination and hardness of White cast iron.
5. Study of Microstructure examination and hardness of Gray cast iron.
6. Study of Microstructure examination and hardness of Mild steel.
7. Study of Microstructure examination and hardness of Aluminum.
8. Study of Microstructure examination and hardness of Magnesium.
9. Study of Microstructure examination and hardness of Copper.
10. Study of Microstructure examination and hardness of Brass.
11. Study of Microstructure examination and hardness of Bronze.
12. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.

SYLLABUS

Master of Vocation (Automobile Technology)

THIRD SEMESTER

AUTOMOTIVE AIR CONDITIONING SYSTEMS

Paper Code: **MVOCAT-201**

Paper: **Automotive Air Conditioning Systems**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I FUNDAMENTALS

Terminology, design factors and concepts related to air conditioning system- construction and working principles of thermostatic expansion valve and orifice tudebased system- Heating system types -detailed study of HVAC components like compressor, evaporator, condenser, TXV, orifice tube , Receiver-drier, heater core etc. Location of air conditioning components in a vehicle

UNIT II REFRIGERANTS & AIR MANAGEMENT SYSTEMS

Refrigerants Temperature and pressure relation, Properties of R-12 and R134a- refrigerant oil Simple problems - Containers - Handling refrigerants - Tapping into the refrigerant container - Ozone Layer Depletion

Air Management Systems - Air routing for manual, semi and automatic system- cases and ducts- Air distribution, control head and doors- Defrost system.

UNIT III AUTOMATIC CLIMATE CONTROL SYSTEM

Block diagram - types of Sensors and Actuators. - Control Logic Electrical wiring diagram of manual and automatic system - multiplexing between BCM and PCM-control of compressor clutch, blower motor etc.- diagnostics tools and features.

UNIT IV DESIGN OF AIR-CONDITIONING COMPONENTS

Modeling of Fixed and variable Displacement type compressor, evaporator modeling - heat transfer correlations for the fluids inside the evaporator, analysis of evaporator frosting-condenser modeling - improvement of refrigerant flow control method.
Air Conditioning Diagnosis and Services: AC system diagnosis based on temperature and pressure measurements, sight glass, sound etc. - refrigerant leak detection- Trouble shooting and Servicing of compressor, evaporator, condenser, heater core etc. – HVAC equipment , recovery and charging. Air routing system service.

TEXT BOOKS:

T[1].Boyce H. Dwiggins, Jack Erjavec., "Automotive Heating and Air-Conditioning", Delmer publisher, 2001.
T[2].Goings. L.F., "Automotive air conditioning", American Technical services, 1974
T[3].James D. Halderman, "Automotive Heating, Ventilation, and Air Conditioning Systems", Pearson Education Inc., 2004.
T[4].MacDonald, K.L., "Automotive air conditioning", Theodore Audel series, 1978.

REFERENCE BOOKS:

R[1].Paul Weiser, "Automotive air conditioning", Reston Publishing Co Inc., 1990
R[2].SAE paper No: 931121,900084, 850040,931137,870029 etc.
R[3].Tom Birch, "Automotive Heating and Air Conditioning" Pearson Education Inc., 2003.
R[4].Vehicle service manuals.
R[5].William H Crouse and Donald L Anglin, "Automotive air conditioning", McGraw - Hill Inc., 1990

ALTERNATIVE FUELS AND ENERGY SYSTEM

Paper Code: **MVOCAT-205** L T/P C

Paper: **Alternative Fuels and Energy System** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I INTRODUCTION

Need for alternate fuel, Availability and properties of alternate fuels, general use of alcohols, LPG, Hydrogen, Ammonia, CNG and LNG, Vegetable oils and biogas, Merits and demerits of various alternate fuels; Introduction to alternate energy sources. Like EV, Hybrid, Fuel cell and solar cars.

UNIT II ALCOHOLS AND OXYGENATES

Properties as engine fuel, Alcohols and gasoline blends, Performance in SI engine, Methanol and gasoline blends, Combustion characteristics in CI engines, Emission characteristics, Oxygenates, Performance in SI & CI Engines.

UNIT III NATURALS GAS, LPG, HYDROGEN AND BIOGAS

Availability of CNG, properties, Modification required using in engines, Performance and emission characteristics of CNG using LPG in SI & CI engines, Performance and emission of LPG. Hydrogen; Storage and handling, Performance and safety aspects.

UNIT IV VEGETABLE OILS

Various vegetable oils for engines, Esterification, Performance in engines, Performance and emission characteristics, Bio diesel and its characteristics.
Electric, Hybrid, Fuel Cell and Solar Cars: Layout of an electric vehicle, Advantage and limitations, Specifications, System components, Electronic control system, High energy and power density batteries, Hybrid vehicle, Fuel cell vehicles, Solar powered vehicles.

TEXT BOOKS:

T[1].Richard.L.Bechfold - Alternative Fuels Guide Book - SAE International Warrendale - 1997.

REFERENCE BOOKS:

R[1].MaheswarDayal - "Energy today & tomorrow" - I & B Horishr India - 1982.
R[2].Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
R[3]."Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
R[4].SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

RESEARCH METHODOLOGY AND DEVELOPMENT COMMUNICATION

Paper Code: **MVOCAT-207** L T/P C

Paper: **Research Methodology and Development Communication** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I INTRODUCTION TO RESEARCH

The hallmarks of scientific research – Building blocks of science in research – Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.

UNIT II EXPERIMENTAL DESIGN

Laboratory and the Field Experiment – Internal and External Validity – Factors affecting internal validity. Measurement of variables – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures.
Soft Skills at Workplace and Business/Work Success: Soft Skills at Workplace: How and Industry Works, Various Departments of Industry, Industry Review, Team building & Motivation, Auto Passion, Confidence Building, Product Development Cycle, Customer Satisfaction & Quality Function Deployment (QFD), Benchmarking, Design for Failure Mode Effects Analysis (DFMEA), Design Review, Vehicle Review.
Business/Work Success : Time Management, Inter personal Skills, Negotiation Skills, Delegating Skills, Executive Summary & Business Report, Handling of Difficult People, Business Analysis, Business Strategy, Meeting Skills, Stress Management & Meditation, Knowledge Management, Project Management, Performance Management System, Total Quality Management.

UNIT III DATA COLLECTION METHODS

Interviewing, Questionnaires, etc. Secondary sources of data collection.Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys. Special Data Sources: Focus Groups. Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-Collection Methods and their utility. Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing. Determination of Optimal sample size.

UNIT IV MULTIVARIATE STATISTICAL TECHNIQUES

Data Analysis-Factor Analysis-Culster Analysis- Discriminant Analysis-Multiple Regression and Correlation –Canonical Correlation-Application of Statistical (SPSS) Software Package in Research.

Research Report: Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a report, Table of contents, Abstract, Synopsis, Introduction, Body of a report – Experimental, Results and Discussion – Recommendations and Implementation section – Conclusions and Scope for future work.

TEXT BOOKS:

T[1].C.R.Kothari, Research Methodology, WishvaPrakashan, New Delhi, 2001.
T[2].Donald H.McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.
T[3].Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2000.
T[4].G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman, 1999.
T[5].Ranjit Kumar, Research Methodology, Sage Publications, London, New Delhi, 1999.
T[6].Raymond-Alain Thie'tart, *et.al.*, Doing Management Research, Sage Publications, London, 1999.

REFERENCE BOOKS:

R[1].Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York, 2000.
R[2].ARAI & SAEINDIA W.S. Proceedings, 3 day Certificate Course on Quality Function Deployment.
R[3].ARAI & SAEINDIA W.S. Proceedings, 3 day Certificate Course on Design Failure Mode & Effect Analysis.
R[4].Haynes Marion E., Effective Meeting Skills, Viva Books.
R[5].Narian Ram, Twelve Management Sill for Success, Viva Books, 2006.
R[6].Verity Judith, Succeeding at Interviews, Viva Books.

CONCEPT OF ENTREPRENEURSHIP

Paper Code: **MVOCAT-209**

Paper: **Concept of Entrepreneurship**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT 1:

Entrepreneur: The evolution of the concept of Entrepreneur,Characteristics of Successful Entrepreneur, Types of Entrepreneur, Functions of an Entrepreneur, Traits of an Entrepreneur. Entrepreneur, Social Entrepreneur. Success stories of young Entrepreneurs of India. (Vijay Shekhar Sharma, Sachin &Binny Bansal, Ritesh Aggarwal Etc.)

Concept of Entrepreneurship: Concept of Entrepreneurship, Growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development, Challenges in Entrepreneurship, Women Entrepreneurship; Problems & Opportunities.

UNIT 2:

Opportunity Identification & Selection: Opportunity Analysis; Need for Opportunity Identification and Selection. Business Environment; Constituents of Business Environment, Types of Business Environment, SWOT & PESTEL Analysis. Business Opportunities in various sectors.

Idea Generation: Sources of Ideas, Methods of Idea Generation, Product Identification, Process of Opportunity Selection, Steps in setting up a small business enterprise.

Formulation of Business Plan& Project Appraisal: Business Plan; Meaning, Contents, Significance, Formulation of Business Plan. Project Appraisal; Meaning of Project Appraisal.

UNIT 3:

Forms of Business Organization: Concept, Advantages & Disadvantages ofSole Proprietorship, Partnership, Limited Liability Partnership, Private Limited Company and Section 8Companies.

Intellectual Property Rights: Patents, Copyrights, Trademarks, Industrial Designs, Trade Secrets, Importance of IPR.

Financing an Enterprise: Meaning & Need of Financial Planning, Sources of Finance; Internal and External Sources, Bootstrapping, Venture Capital, Angel Investment and Incubation Fund. Capital Structure; Factors Determining Capital Structure.

Scheme and Syllabus of M.Voc in Automobile Technology is approved in BoS of USIC&T on 27th August, 2018.

UNIT 4:

Business Functions: Management; Functions and Importance, Marketing; Meaning, Process, 4 P's, Human Resource Management; Building a Team, Accounting; Meaning & Need, Corporate Social Responsibility (CSR).

Institutional Support to Entrepreneurs: Central & State Level Institutions, Other Agencies. Industry Association; CII, FICCI, PHDCCI and ASSOCHAM.

Government Policies: Start-Up India, Make in India, Mudra, Atal Incubation Centres.

Text Books:

T[1] . Dr. S.S. Khanka, "Entrepreneurial Development", S. Chand Publishing, 2016.
T[2] Poornima M Charantimath, "Entrepreneurship Development & Small Business Development", Pearson Publishing, 2012.

Reference Books:

R[1]. ZimmererScarborough, "Essentials of Entrepreneurship and Small Business Management" Pearson Publishing.
R[2]. David H Holt "Entrepreneurship - New venture Creation" PHI Publishing.
R[3]. Dr C B Gupta, Dr N P Srinivasan "Entrepreneurship Development" S. Chand Publishing.
R[4]. Vasant Desai "Dynamics of Entrepreneurship Development and Management" Himalaya Mumbai.

MARKETING MANAGEMENT

Paper Code: **MVOCAT-211**

Paper: **Marketing Management**

L	T/P	C
3	0	3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I

Concepts in Marketing - Marketing Process, Marketing concepts, Environment-Buying Behaviour and Market Segmentation-factors, Motives, Types, Buying Decision, Segmentation
factors, Demographic, Psychographic and Geographic Segmentation, Process, Patterns

UNIT II

Product Pricing and Marketing Research- Pricing, Decisions and Pricing Methods, Pricing Management-Marketing Planning and Strategy Formulation-Portfolio Analysis, BCG, GEC Grids

UNIT III

Advertising, Sales Promotion and Distribution-Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling propositions, Characteristics.

UNIT IV

Wholesaling, Retailing, Channel Design, Logistics Modern Trends in Retailing.

TEXT BOOKS:

[T1]. Kotler Philip, Kevin Lane Keller, "Marketing Management", 13th Ed., Pearson Education
(Singapore) Pvt. Ltd., New Delhi, 2007.
[T2]. Zikmund DAmico, "The power of Marketing", 7th edition, South Western, Thomson Learning Publications, 2006.

REFERENCE BOOKS:

[R1]. Michael J. Etzel, Bruce J. Walker, William J. Stanton, Ajay Pandit, "Marketing – concepts and cases", special Indian edition, McGraw Hill

Paper Code: **MVOCAT-213** L T/P C

Paper: **MIS and ERP** 3 0 3

INSTRUCTION TO PAPER SETTERS **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Unit I:

Information Systems in Business: Concepts of Data, Information, Knowledge &Intelligence, Attributes of Information.Trends in Information Systems, e-Business in Business, Managerial Challenges of Information Technology, Strategic IT, Value Chain and Strategic IS, Knowledge Information Systems, Foundations of Business Intelligence: Databases and Information Management, The meaning and role of MIS

Data Resource Management: Database Management Concepts, Database Structures: Hierarchical, network, relational, multidimensional, object oriented; Types of Databases, Introduction to Data warehouses and Data Mining

Unit II:

Business Applications: e-Business Systems, Functional Business Systems

E-Commerce: Application of E Commerce in Direct Marketing and Selling, Types of E-Commerce,Operational & Strategic benefits of E-commerce; E-cash- Purchasing & using of e-cash; Electronic Purses their loading with cash and use; E-cheque payment system; Online Third Party Verified PaymentSystem through Credit & Debit Cards & encryption mechanism,

Case Study: Amazon vs. Walmart

Unit III:

Decision Making in Business: Information quality; Decision Support Systems; Online Analytical Processing; What-if Analysis; Data mining; Executive Information Systems; Artificial intelligence and Business applications; Expert systems; Neural Networks; Fuzzy Logic Systems; Virtual Reality; Intelligent Agents

Case Study: Kimberly-Clark Corp.: Shopping for Virtual Products in Virtual Stores

Management Challenges: Cyber-crime; Privacy Issues; Cyber Law; Health and Societal issues

Unit IV:

ERP: ERP overview; need of ERP; growth of ERP; benefit; Proper and improper ERP implementation; ERP modules and vendors: Finance; production planning, control & maintenance, sales & distribution- General Ledger and Normal Ledger; human resource management (HRM); inventory control system; quality management; ERP market; ERP and E-Commerce.

Case Studies on ERP.

Scheme and Syllabus of M.Voc in Automobile Technology is approved in BoS of USIC&T on 27th August, 2018.

Textbooks:

1. Management Information System, 8th Edition, James A. O' Brien , George Marakas.
2. Management Information System, 9th Edition, Kenneth C. Laudon, Jane P. Laudon
3. Enterprise Resource Planning, Leon, Alexis, Tata McGraw-Hill, 1999

Reference Books:

1. Introduction to Information Systems: Supporting and Transforming Business By: Rainer, Turban, Potter, 1st Edition
2. Management Information Systems,Kroenke, Mc-Graw Hill.
3. Information Systems for Modern Management, third edition by R. G. Murdick, J. E. Ross and J. R. Clagget, PHI – 1994.
4. ERP Ware: ERP Implementation Framework, Garg, V.K. ,&Venkitakrishnan, N.K.

AUTOMOTIVE AIR CONDITIONING SYSTEMS LAB

Paper Code: **MVOCAT-251**

Paper: **Automotive Air Conditioning Systems Lab**

L	T/P	C
0	8	4

***Note:** - The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.*

LIST OF EXPERIMENTS

1. Identify and study of A/C components and operation.
2. Identify and study of refrigerant types.
3. Perform an A/C system performance test.
4. Identify and recover A/C system refrigerant.
5. Conduct Leak test A/C system.
6. Study of the Compressor: open type and sealed types.
7. Study of the Thermostatic expansion valve and Solenoid valve.
8. Study of the Surface condenser and Different types of evaporators.
9. Study of the Thermostat for refrigeration, H.P. and L.P. cut out, Gil safety switch, Strainers and driers.
10. Study, Dismantling and assembly of A/C compressor components.
11. Air removal and charging of a refrigeration unit.
12. Study of A/C condenser for airflow restrictions.
13. Dismantling and study of A/C system mufflers, hoses, pipes, fittings, seals, and service valves
14. Dismantling and install receiver/drier or accumulator/drier
15. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.