UNIVERSITY OF MUMBAI

Revised syllabus (Rev- 2016) from Academic Year 2016 -17
Under

FACULTY OF TECHNOLOGY

Automobile Engineering

Second Year with Effect from AY 2017-18
Third Year with Effect from AY 2018-19
Final Year with Effect from AY 2019-20

As per **Choice Based Credit and Grading System**
with effect from the AY 2016–17

Co-ordinator, Faculty of Technology's Preamble:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEOs) and give freedom to affiliated Institutes to add few (PEOs). It is also resolved that course objectives and course outcomes are to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Semester based Credit and grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 2-3 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Choice based Credit and grading system is implemented from the academic year 2016-17 through optional courses at department and institute level

Dr. S. K. Ukarande
Co-ordinator,
Faculty of Technology,
Member - Academic Council
University of Mumbai, Mumbai

Chairman's Preamble:

Engineering education in India is expanding and is set to increase manifold. The major challenge in the current scenario is to ensure quality to the stakeholders along with expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education and reflects the fact that in achieving recognition, the institution or program of study is committed and open to external review to meet certain minimum specified standards. The major emphasis of this accreditation process is to measure the outcomes of the program that is being accredited. Program outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation from the program. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating the philosophy of outcome based education in the process of curriculum development.

As the Chairman, Board of Studies in Mechanical Engineering of the University of Mumbai, I am happy to state here that, the Program Educational Objectives for Undergraduate Program were finalized in a brain storming sessions, which was attended by more than 40 members from different affiliated Institutes of the University. They are either Heads of Departments or their senior representatives from the Department of Mechanical Engineering. The Program Educational Objectives finalized for the undergraduate program in Mechanical Engineering are listed below;

1. To prepare the Learner with a sound foundation in the mathematical, scientific and engineering fundamentals
2. To motivate the Learner in the art of self-learning and to use modern tools for solving real life problems
3. To inculcate a professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's thought process
4. To prepare the Learner for a successful career in Indian and Multinational Organisations

In addition to Program Educational Objectives, for each course of the program, objectives and expected outcomes from a learner's point of view are also included in the curriculum to support the philosophy of outcome based education. I strongly believe that even a small step taken in the right direction will definitely help in providing quality education to the major stakeholders.

Dr. S. M. Khot

Chairman, Board of Studies in Mechanical Engineering, University of Mumbai

Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract	Theory	Pract	Total
AEC801	Vehicle Maintenance	03	--	03	--	03
AEC802	Vehicle Dynamics	04	--	04	--	04
AEC803	Vehicle Safety	03	--	03	--	03
AEDLO 804X	Department Level Optional Course IV	04	--	04	--	04
ILO802X	Institute Level Optional Course II[#]	03	--	03	--	03
AEL801	Automotive Workshop	--	04	--	02	02
AEL802	Vehicle Dynamics	--	02	--	01	01
AEP801	Project II	--	12	--	06	06
Total		**17**	**18**	**17**	**09**	**26**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		Test1	Test 2	Avg					
AEC801	Vehicle Maintenance	20	20	20	80	03	--	--	100
AEC802	Vehicle Dynamics	20	20	20	80	03	--	--	100
AEC803	Vehicle Safety	20	20	20	80	03	--	--	100
AEDLO 804X	Department Level Optional Course IV	20	20	20	80	03	--	--	100
ILO802X	Institute Level Optional Course II[#]	20	20	20	80	03	--	--	100
AEL801	Automotive Workshop	--	--	--	--	--	25	25	50
AEL802	Vehicle Dynamics	--	--	--	--	--	25	25	50
AEP801	Project II	--	--	--	--	--	50	100	150
Total				**100**	**400**		**100**	**150**	**750**

Course Code	Department Level Elective Course IV	Course Code	Institute Level Elective Course II[#]
AEDLO8041	Hybrid Electric and Fuel cell Vehicles	ILO8021	Project Management
AEDLO8042	Rapid Prototyping*	ILO8022	Finance Management
AEDLO8043	Product Design and Development	ILO8023	Entrepreneurship Development and Management
AEDLO8044	Transport Management and Motor Industry	ILO8024	Human Resource Management
		ILO8025	Professional Ethics and CSR
		ILO8026	Research Methodology
		ILO8027	IPR and Patenting
		ILO8028	Digital Business Management
		ILO8029	Environmental Management

***Common with Mechanical Engineering**

[#] Common with all branches

Course Code	Course Name	Credits
AEC 801	Vehicle Maintenance	3

Objectives

1. To study basic types of vehicle maintenance along with its importance.
2. To become aware about workshop skills and career opportunities available in Automobile Industry.
3. To acquaint with various Trouble shooting, fault tracing practices available in automobile industry.

Outcomes: Learner will be able to…

1. Demonstrate the maintenance procedure for automotive Engine and prepare checklist.
2. Comprehend of the operation of OBD for diagnosing various faults.
3. Identify the trouble diagnosis procedure for steering and suspension system.
4. Illustrate the trouble diagnosis procedure for electrical systems like Battery, starting Systems etc.
5. Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
6. Illustrate trouble diagnosis procedure for heating system of automobile.

Module	Detailed Contents	Hrs.
01	**Types of Maintenance** **Automotive Engine Diagnosis:** 1.1 Lower End Theory and Service ✓ Short Block Disassembly ✓ Cylinder Block and its Reconditioning ✓ Camshaft, Crankshaft, Crankshaft Inspection and Rebuilding ✓ Installing Main Bearings and Crankshaft ✓ Piston and Piston Rings ✓ Installing Pistons and Connecting Rods ✓ Inspection and Installation of Camshaft and Related Parts ✓ Crankshaft and Camshaft Timing 1.2Upper End Theory and Service ■Cylinder Head ■ Combustion Chamber ■ Intake and Exhaust Valves ■Variable Valve Timing ■ Cylinder Head Disassembly ■ Inspection of the Valve Train ■ Servicing Cylinder Heads ■ Reconditioning Valves ■ Valve Guide Reconditioning ■ Reconditioning Valve Seats ■Valve Stem Seals ■ Assembling the Cylinder Head 1.3 Preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms	05
02	**Maintenance of Engine Accessories** 2.1 Emission control system (SI & CI): Theory, Diagnosis and service 2.2 Restraint system : Theory, Diagnosis and service	06

	2.3 OBD-I and OBD-II: Theory and various systems to diagnose the engine faults.	
03	**Maintenance of Automotive Systems** 3.1 Manual & Automatic Transmission: Diagnosis and service 3.2 Steering system: Diagnosis service 3.3 Suspension system: Diagnosis service 3.4 Braking system : Theory, Diagnosis and service 3.5 Tires and wheels: Diagnosis and service	10
04	**Maintenance of Automobile Electronics Components and Accessories** 4.1 Batteries: Diagnosis and service ■ Servicing and Testing Batteries ■ Isolating High-Voltage Systems ■ Jump-Starting 4.2 Charging system Diagnosis and service 4.3 Starting system Diagnosis and service 4.4 Electrical Instrumentation and Electrical accessories ■ Windshield Wiper/Washer Systems ■ Horns/Clocks/Cigarette Lighter Systems ■ Cruise (Speed) Control Systems ■ Sound Systems ■ Power Lock Systems ■ Power Windows ■ Power Seats ■ Power Mirror System ■ Rear-Window Defrosters and Heated Mirror Systems ■ Other electronic Equipment ■ Security and Antitheft Devices	08
05	**Maintenance of Lubrication ,Cooling ,Fuel Delivery Lubrication System Diagnosis and service** 5.2 Lubrication system : Theory , Diagnosis and service 5.2 Cooling System : Theory , Diagnosis and service ✓ Inspection of Cooling System ✓ Testing for Leaks ✓ Cooling System Service 5.3 Fuel delivery system diagnosis and service	06
06	**Maintenance of Heating and air conditioning Systems& career opportunities** ➢ **Maintenance of Heating and air conditioning Systems** 6.1 Ventilation System 6.2 Automotive Heating Systems 6.3 Heating System Service 6.4 Theory of Automotive Air-Conditioning Refrigerants 6.5 Basic Operation of an Air-Conditioning System 6.6 Air-Conditioning Systems and Controls 6.7 Temperature Control Systems ➢ **Air conditioning and diagnostic service**	04

	6.8 Service Precautions 6.9 Refrigerant Safety Precautions Guidelines for Converting (Retrofitting) R-12 Systems to R-134a 6.10Initial System Checks Diagnosis 6.11 Performance Testing Leak Testing 6.12 Recharging the System Climate Control Systems ➢ **Career opportunities** 6.13Training for a Career in Automotive Service Industry 6.14 ASE Certification: Opportunities under Make in India initiatives	

Theory Examinations:

Internal Assessment for 20 marks:
Consisting **two compulsory class tests**
First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

Reference Books:

1. James D Halderman - Advanced Engine Performance Diagnosis – PHI - 1998.
2. Service Manuals from Different Vehicle Manufacturers.
3. Automotive Trouble shooting and Maintenance by Anderson Ashburn.
4. Venk. Spicer, Automotive Maintenance and Trouble shooting.
5. Automotive Technology :A Systems Approach, 5e Jack Erjavec/Delmar Cengage Learning.
6. Automotive Mechanics, William Crouse and Donald Anglin /TATA Mc Graw-hill.
7. Automotive Technology, Joseph Heitner.
8. Automotive Electrical and Electronic Systems by John F. Kershaw, James D.Halderman.

Course Code	Course Name	Credits
AEC 802	Vehicle Dynamics	4

Objectives

1. To familiarize with basic concepts of vehicle dynamics.
2. To acquaint with concepts of stability of vehicles and their effects.

Outcomes: Learner will be able to…

1. Analyze the vehicle directional stability.
2. Enumerate the suspension systems, tire dynamics & directional stability of the vehicle.
3. Develop physical and mathematical models to predict the dynamic response of vehicles
4. Demonstrate the ride characteristic of the vehicle.
5. Analyze the vehicle roll behaviour
6. Comprehend the various trends in Vehicle Dynamics.

Module	Detailed Contents	Hrs.
01	**Introduction** History of Road and Off Road Vehicle System dynamics, Equation of Simple Spring Mass System of Two Masses, Motion after the Hump, Acceleration for stepped input, Single Mass system of Two degree of freedom, Conjugate Points, Elastic, Dynamic, doubly Conjugate Points, Calculation of Conjugate Points, Road Load, Aerodynamics-Drag, Side force, Lift force, Rolling Resistance, Total Road Loads,	08
02	**Tyres** SAE Tyre axis system, Tyre forces, Moments, Lateral force V/S Slip Angle, Aligning Torque V/S Slip Angle, Tyre Construction, Tractive Properties, Cornering Properties, Camber Thrust, Aligning Moment, Combined and Cornering, Conicity and Ply Steer, Tire Vibration, Tyre Properties affecting Vehicle Roll over, Introduction to Magic Tyre Formula.	08
03	**Suspension** Solid Axles, Independent suspensions, Anti Squat and Anti Pitch Suspension Geometry, Anti Drive Suspension Geometry, Roll Centre Analysis, Active Suspension, Motion Analysis of Wheel Suspension. Equalizing Suspension, Variable Rate Leaf Spring.	08
04	**Ride** Sources for vehicle vibration, vibration isolation, Effects of damping the vibration, vibration absorbers, pitch and bounce motion frequencies.	08
05	**Steering** Steering geometry, Front wheel geometry, Steering system forces and moments, Steering system effects, Influence of front wheel drive, Four wheel steering, Suspension effect of cornering, Steady state and Transient behaviour.	08
06	**Recent Trends in Vehicle dynamics** Vehicle dynamic Control, Modelling of Actuators, Sensors for Automobile Control, Sensors for Detecting Vehicle Environment, Central Tyre Inflation system.	08

Theory Examinations:

Internal Assessment for 20 marks:

Consisting **two compulsory class tests**

First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

Reference Books:

1. Gillespie T.D, ―Fundamentals of Vehicle Dynamics‖, SAE USA 1992
2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.
3. Road and Off Road Vehicle system Dynamics: Hand Book
4. Mechanics of Road Vehicle: Steeds
5. Automobile Suspension and Handling : Colin Campell
6. Car Suspension : Bastow
7. Race Car Vehicle Dynamics: William F Milliken and Douglas L Milliken

Other references:

1. J. Y. Wong, "Theory of Ground Vehicles", 3rd ed., John Willey & Sons, New York, 1997.
2. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication – 2002
3. Heinz Heisler, "Advanced Vehicle Technology ", 2nd Edition, Butterworth-Heinemann, 2002

Course Code	Course Name	Credits
AEC 803	VEHICLE SAFETY	3

Objectives:

1. To familiarize with basic concepts of vehicle safety
2. To familiarize accident reconstruction analysis methods
3. To acquaint with different issues related to vehicle safety in India and Abroad.

Outcomes: Learner will be able to

1. Comprehend Vehicle design from safety point of view.
2. Apply concepts of accident reconstruction analysis in real world.
3. Enumerate interrelation ship among occupant, restraint systems and vehicles in accidents.
4. Illustraterole and significance of seat in Rear crash safety
5. Demonstrate different active and passive safety systems available in vehicles
6. Illustrate various standards related to vehicle safety.

Module	Detailed Contents	Hrs.
01	Introduction to vehicle safety Basic concepts of vehicle safety Risk evaluation and communication Human error control Universal design The distracted driver Crash Testing	06
02	Accident Data Biomechanics and Occupant Simulation Vehicle Body Testing Dynamic Vehicle Simulation Tests Occupant Protection Pedestrian Protection Compatibility Interrelationship Among Occupants, Restraint Systems and Vehicle in Accidents	06
03	Significance of Rear Crash Safety Role of seat in Rear crash safety Performance criteria for different seats Ultra high Retention seats	08
04	Introduction to Accident Analysis Reconstruction methods Uncertainty in Measurement and cautions Tire forces Straight-line Motion Critical speed from Tire Yaw marks Reconstruction of Vehicular Rollover Accidents Analysis of Collisions Reconstruction Applications Impulse Momentum Theory Crush Energy Frontal Vehicle –Pedestrian Collision Photogrammetry for accident constructions	10

05	Antilock braking system Traction control system Electronic Stability Program Low tire pressure warning system Collision avoidance systems	04
06	Automotive Industry Standards Transport EngineeringStandards Indian road congress Standards	04

Theory Examinations:

Internal Assessment for 20 marks:

Consisting **two compulsory class tests**

First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

References Books:

1. Automotive vehicle safety by George Peters and Barbara Peters, CRC Press, 2002.
2. Understanding Automotive electronics by William Ribbens, Newnes, Sixth Edition, 2003.
3. Vehicle Accident Analysis and Reconstruction Methods by Raymond M. Brach and R. Matthew Brach, SAE International, Second Edition, 2011.
4. Role of the seat in rear crash safety by David C. Viano, SAE International, 2002.
5. Automotive Safety Handbook by Ulrich W. Seiffert and LotharWech, SAE International, 2007.
6. Public Safety Standards of the Republic of India

Course Code	Course Name	Credits
AEDLOC8041	Hybrid Electric and Fuel Cell Vehicles	4

Objectives

1. To familiarize with basic Concepts of Hybrid, Electric and Fuel Cell vehicles.
2. To acquaint with various aspects of hybrid and electric drive train
3. To study various challenges involved with Fuel cell technology.

Outcomes: Learner will be able to…

1. Illustrate different types of Fuel cells, its operation, and performance.
2. Quantify fuel cell processing using codes and standards.
3. Comprehend basic concept of Hybrid and Electric traction.
4. Illustrate various Architectures related to Hybrid Drive train.
5. Illustrate need and environmental importance of Hybrid technology.
6. Analyse hybrid vehicles.

Module	Detailed Contents	Hrs.
01	**Fuel Cell Technology**-Unit Cells, Fuel cell stacking, Fuel cell Types (Polymer Electrolyte Fuel cell, Alkaline Fuel cell, Phosphoric acid Fuel cell, Molten carbonate fuel cell, and Solid oxide fuel cell), and Timeline of introduction of fuel cell technology in automobiles.	04
02	**Fuel Cell Performance**-Role of Gibbs free energy and Nernst Potential, Cell Energy balance, Cell efficiency, Performance variables, various mathematical models.	04
03	Polymer Electrolyte Fuel cell-Cell Components,PEFC systems Alkaline Fuel Cell-Cell component, Performance Introduction to Fuel cell Hybrids, Fuel cell Auxiliary Power Systems Sample Calculations-Fuel cell Calculations, Fuel Processing Calculations for PEFC,AFC.Fuel cell related codes and Standards	08
04	**Hybrid Electric Technology and Electric drive trains**-Introduction,History,Environmental importance, Basic concept of Hybrid Traction, Basic concept of electric traction, Introduction of electric components used in electric vehicles,	06
05	Principles of Hybrid Electric Drive trains, Architectures – Electrical distribution, Hybrid control Strategies – Parallel Hybrid, Series Hybrid - (Charge Sustaining, Charge Depleting), Practical Models – Toyota Prius, Honda Insight. Hybridization Effects. 42 V System for Traction Applications - Lightly Hybridized vehicles, Low–Voltage Storage System, Low –Voltage main system with High voltage bus for propulsion.	08
06	**Hybrid Vehicle Technology**-Sizing the drive system: Matching the electric machine and the internalcombustion engine (ICE), Sizing the propulsion motor, sizing the powerelectronics, selecting the energy storage technology, Communications, supportingsubsystems. Energy Management Strategies in hybrid and electric vehicles,classification of different energy management strategies, comparison of differentenergy management strategies, implementation issues of energy managementstrategies. **Case Studies**: Design of a Hybrid Electric Vehicle (HEV), Design of aBattery Electric Vehicle (BEV).	08

Theory Examinations:

Internal Assessment for 20 marks:
Consisting **two compulsory class tests**
First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

Reference Books:

1) Hoogers, G., Edr. *"Fuel Cell Technology Handbook*", CRC Press, Washington D. C., 2003
2) Larminie, J. and Dicks, A., "*Fuel Cell Systems Explained"* John Wiley & Sons, Ltd., New York, 2001.
3) Fuel Cell Handbook by EG &G Technical Services,Inc.Seventh Edition
4) Ali Emadi, Mehrdad Ehsani, John M. Muller, "*Vehicular Electric Power Systems",* Marcel Dekker, Inc., 2004.

Course Code	Course Name	Credits
AEDLO8042	Rapid Prototyping*	04

Objectives

1. To familiarise with importance of Rapid Prototyping in Product Development.
2. To acquaint with the Synergic Integration Technologies

Outcomes: Learner will be able to…

1. Select the feasible RP process
2. Selct the feasible RP material
3. Gauge and Hybridize the ever-evolving Protoyping Technologies
4. Contribute towards the Product Development at the respective domain in the industry
5. Apply RP to build working prototypes
6. Demonstrate basics of virtual reality

Module	Detailed Contents	Hrs.
01	Introduction: Product Development Cycle and the product Life Cycle. Problems in Product Development and the use of Synergic Integration Technologies. Relationship between Product Development Cost and the Selling Price. Where does RP stand. Classification of RP systems, advantages and limitations of RP, Applications and scope of RP, supported file formats and introduction to Solid Modelling.	10
02	Laminated Object Manufacturing (LOM), principle of operation, possible approaches, steps, advantages and limitations. Stadard Machine Specifications. Fused Deposition Modelling (FDM), principle of operation, process steps, advantages and limitations. Stadard Machine Specifications. Stereolithography Apparatus (SLA): Principle, process steps, advantages and limitations, Stadard Machine Specifications. Selective Laser Sintering (SLS): Principle, process steps, advantages and limitations, Stadard Machine Specifications.	12
03	Solid Ground Curing (SGC): Principle, process steps, advantages and limitations, PhotoMasking comparative with SLA and LOM ObJet: Principle, process steps, advantages and limitations, applications, Stadard Machine Specifications. 3D Printing: Principle, process steps, advantages and limitations, classification of printer family, Stadard Machine Specifications, DIY procedures.	12
04	Rapid Tooling: Need for metallic tooling, approaches, RP Processes for Tooling, Silicon Rubber Molding, Epoxy Tooling, Spray Metal Tooling, Cast Kirksite Tooling, 3D KelTool, QuickCast.	05
05	Materials for Rapid Prototyping Systems: Nature of material, types of material; polymers, metals, ceramics and composites, liquid based materials; photo polymer development, solid based materials; powder based materials.	05
06	Reverse Engineering: Introduction to Digitizing Methods; contact type and non-contact type, brief introduction to the types of medical imaging. Virtual reality: Definition, features of VR, Technologies used in VR, Introduction to Augmented reality.	04

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

References:

1. Rapid Prototyping, Principles and Applications byRafiqI. Noorani, Wiley & Sons
2. Rapid Prototyping: Principles and Applications byChua C.K, Leong K.F and Lim C.S, 2nd Edition, World Scientific
3. Rapid Manufacturing – An Industrialrevolution for the digital age by N.Hopkinson, R.J. M.Hauge, P M, Dickens, Wiley
4. Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping byIan Gibson, Wiley
5. Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography byPaul F.Jacobs, McGraw Hill
6. Rapid Manufacturing byPham D T and Dimov SS, Springer Verlog

Course Code	Course Name	Credits
AEDLO8043	Product Design and Development	4

Objectives

1. To familiarize with basic concepts of product design
2. To acquaint with product design methodologies
3. To acquaint with product design needs and issues in industry

Outcomes: Learner will be able to…

1. Demonstrate product design and development process.
2. Illustrate considerations of Design for Manufacturing and Assembly in product development.
3. Analyze a product in perspective of aesthetic and ergonomic considerations.
4. Illustrate concepts of QFD aspects in product development.
5. Demonstrate applicability of value engineering in product optimization.
6. Demonstrate legal and social issues pertaining to product development.

Module	Detailed Contents	Hrs.
01	**1. INTRODUCTION** 1.1 Introduction to product design. 1.2 Classification/ Specifications of products. 1.3 Product life cycle & Product mix. 1.4 Modern product development process. 1.5 Innovative thinking. 1.6 Morphology of design (7 phases)	08
02	**2. CONCEPTUAL DESIGN** 2.1 Generation, selection & embodiment of concept. 2.2 Product architecture. 2.3 Significance of Industrial design process. 2.4 Introduction to Design Of Experiments (DOE) for Robust Design, Taguchi Designs.	08
03	**3. DESIGN FOR MANUFACTURING AND ASSEMBLY** 3.1 Methods of designing for manufacturing & assembly. 3.2 Designs for maintainability. 3.3 Designs for environment. 3.4 Product costing.	10
04	**4. DESIGN METHODOLOGIES** 4.1 Value engineering and Value analysis. 4.2 Failure Mode Effect Analysis (FMEA) 4.3 Concurrent engineering 4.4 Quality Function Deployment (QFD) 4.5 Reverse engineering	10
05	**5. DESIGN FACTORS** 5.1 Ergonomics and Aesthetics. 5.2 Anthropometry. 5.3 Man-Machine interaction. 5.4 Concepts of size and texture, color	06

	5.5 Comfort criteria. 5.6 Psychological & Physiological considerations. 5.7 Economic factors.	
06	**6. PRODUCT DESIGN NEEDS AND ISSUES IN INDUSTRY** 6.1 Customer needs: types, models and collection of customer needs information, analysis of information**,** Rapid prototyping, Tools for product design – Drafting / Modeling software, CAM interface. 6.2 Creativity Techniques: Creative thinking, conceptualization, Brain storming, primary design, drawing, simulation, detail design. 6.3 Legal and social issues. Engineering ethics and issues of society related to design of products, Patents & IP Acts. Overview, Disclosure preparation.	06

Theory Examinations:

Internal Assessment for 20 marks:
Consisting **two compulsory class tests**
First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

Reference Books:

1. Karl T Ulrich, Steven D Eppinger, “Product Design & Development.”, Tata McGraw-Hill New Delhi 2003.
2. David G Ullman, “The Mechanical Design Process.” McGrawhill Inc.
3. N J M Roozenberg, J Ekels, N F M Roozenberg “Product Design Fundamentals and
4. Methods”, John Willey & Sons 1995.
5. Hollins B & Pugh S “Successful Product Design.” Butterworths London.
6. Baldwin E. N. & Neibel B. W. “Designing for Production.”, Edwin Homewood Illinois
7. Jones J. C. “Design Methods.” Seeds of Human Futures, John Willey New York.
8. Bralla J. G. “Handbook of Product Design for Manufacture, McGrawhill NewYork**.**
9. K. Chitale; R.C. Gupta, Product Design and Manufacturing, Prentice - Hall India.
10. Dieter George E., Engineering Design McGraw Hill Pub. Company, 2000.

Course Code	Course Name	Credits
AEDLO8044	Transportation Management & Motor Industry	4

Objectives:

1. To familiarize with basic concepts of transport management
2. To acquaint with different types of motor insurance.

Outcomes: Learner will be able to…

1. Demonstrate transport management systems
2. Implement advance techniques in traffic management
3. Demonstrate understanding of motor vehicle act.
4. Interpret about vehicle insurance and taxation.
5. Illustrate the knowledge of Passenger transport operation.
6. Illustrate the knowledge of Goods transport operation

Module	Detailed Contents	Hrs.
01	**1. Motor Vehicle Act** 1.1 Short titles & definitions 1.2 Laws governing to use of motor vehicle & vehicle transport 1.3 Licensing of drivers & conductors 1.4 Registration of vehicle 1.5 State & interstate permits 1.6 Traffic rules, Signals & controls 1.7 Accidents, Causes & analysis 1.8 Liabilities & preventive measures 1.9 Rules & regulations 1.10 Responsibility of driver 1.11 Public & public authorities 1.12 Offences, penalties & procedures 1.13 Different types of forms 1.14 Personnel, Authorities & duties 1.15 Rules regarding construction of motor vehicles 1.16 Tourist and National Permits 1.17 Fitness of a Motor Vehicle 1.18 Rules for Special Purpose Vehicle(Off Road vehicle, Specially designed vehicle ,Government Department Vehicle)	10
02	**2. Taxation** 2.1 Objectives 2.2 Structure & methods of laving taxation 2.3 One-time tax 2.4 Tax exemption & tax renewal 2.5 Types of Tax 2.6 Different types of Tax at Vehicle Registration Renewal	10
03	**3. Insurance** 3.1 Insurance types & significance 3.1.1 Comprehensive plus zero depreciation 3.1.2 Third party insurance 3.2 Furnishing of particulars of vehicles involved in accident 3.3 MACT (Motor Accident Claims Tribunal) 3.4 Solatium Fund 3.5 Hit & Run case 3.6 Duty of driver in case of accident	08

	3.7 Surveyor & Loss Assessor, Surveyor's report 3.8 Role of Surveyor 3.9 Settlement of Insurance and Procedure of Investigation	
04	**4. Passenger Transport Operation** 4.1 Structure of passenger transport organizations 4.2 Typical depot layouts 4.3 Requirements and Problems on fleet management 4.4 Fleet maintenance 4.5 Planning - Scheduling operation & control 4.6 Personal & training-training for drivers & conductors 4.7 Public relations, Propaganda, publicity and passenger amenities 4.8 Parcel traffic. 4.9 Theory of fares-Basic principles of fare charging 4.10 Differential rates for different types of services 4.11 Depreciation & debt charges 4.12 Operation cost and Revenues 4.13 Economics & records 4.14 Maintenance management of State Transport Undertaking (STU) 4.15 Bus Rapid Transport system (BRTS)	10
05	**5. Goods Transport Operation** 5.1Scheduling of goods transport 5.2 Management Information System (MIS) in passenger / goods transport operation 5.3Storage & transportation of petroleum products 5.4 Intelligent Transport System (ITS)	06
06	**6. Advance Techniques in Traffic Management** 6.1 Traffic navigation 6.2 Global positioning system	04

Theory Examinations:

Internal Assessment for 20 marks:

Consisting **two compulsory class tests**

First test based on initial 40% of the content and second test based on remaining content (but excluding contents covered in Test I).

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

i. Question paper will comprise of total six questions.
ii. All questions carry equal marks.
iii. Questions will be mixed in nature (for example Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
iv. Only four questions need to be solved.

Reference Books:

1. Motor Vehicle Act - Governmment of India Publications
2. Economics of Transport, S.K. Shrivastava
3. Transport Development in India, S. Chand & Co. Pvt. Ltd., New Delhi.
4. CMVR-1989
5. Peter R. White: Public Transport: Its Planning, Management and operation (Natural and Built Environment Series, Kindle Edition, September 2008.)
6. John Doke-Fleet Management
7. Kitchin L.D. - Bus Operation, Illiffe and sons Co. London, III edition

Course Code	Course Name	Credits
ILO 8021	Project Management	03

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: Learner will be able to…

1. Apply selection criteria and select an appropriate project from different options.
2. Write work break down structure for a project and develop a schedule based on it.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference

Module	Detailed Contents	Hrs
01	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
02	**Initiating Projects:** How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	6
03	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS).	8
04	**Planning Projects:** Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
05	**5.1 Executing Projects:** Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings **5.2 Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **5.3 Project Contracting** Project procurement management, contracting and outsourcing,	8

06	**6.1 Project Leadership and Ethics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **6.2 Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7thEd
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning
4. Gopalan, Project Management, , Wiley India
5. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

Course Code	Course Name	Credits
ILO 8022	Finance Management	03

Objectives:

1. Overview of Indian financial system, instruments and market
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management
3. Knowledge about sources of finance, capital structure, dividend policy

Outcomes: Learner will be able to…

1. Understand Indian finance system and corporate finance
2. Take investment, finance as well as dividend decisions

Module	Detailed Contents	Hrs
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	06
02	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	06
03	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	09
04	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	10
05	**Sources of Finance:** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.	05

	Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	
06	**Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	03

Assessment:

Internal Assessment for 20 marks:
Consisting **Two Compulsory Class Tests**
First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Course Code	Course Name	Credits
ILO8023	Entrepreneurship Development and Management	03

Objectives:

1. To acquaint with entrepreneurship and management of business
2. Understand Indian environment for entrepreneurship
3. Idea of EDP, MSME

Outcomes: Learner will be able to…

1. Understand the concept of business plan and ownerships
2. Interpret key regulations and legal aspects of entrepreneurship in India
3. Understand government policies for entrepreneurs

Module	Detailed Contents	Hrs
01	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
02	**Business Plans And Importance Of Capital To Entrepreneurship:** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur **Entrepreneurship And Business Development:** Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	09
03	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	05
04	**Indian Environment for Entrepreneurship:** key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	08
05	**Effective Management of Business:** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	08
06	**Achieving Success In The Small Business:** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	05

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. PoornimaCharantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. MaddhurimaLall, ShikahSahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. LaghuUdyogSamachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Course Code	Course Name	Credits
ILO8024	Human Resource Management	03

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

Outcomes: Learner will be able to…

1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioural skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

Module	Detailed Contents	Hrs
01	**Introduction to HR** • Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions • Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues	5
02	**Organizational Behaviour (OB)** • Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues • Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness • Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour • Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); • Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. • Case study	7
03	**Organizational Structure &Design** • Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. • Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. • Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	6
04	**Human resource Planning**	5

	• Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale • Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning • Training & Development: Identification of Training Needs, Training Methods	
05	**Emerging Trends in HR** • Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment • Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation	6
06	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM:** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws & Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	10

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Course Code	Course Name	Credits
ILO8025	Professional Ethics and Corporate Social Responsibility (CSR)	03

Objectives:

1. To understand professional ethics in business
2. To recognized corporate social responsibility

Outcomes: Learner will be able to…

1. Understand rights and duties of business
2. Distinguish different aspects of corporate social responsibility
3. Demonstrate professional ethics
4. Understand legal aspects of corporate social responsibility

Module	Detailed Contents	Hrs
01	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
02	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
03	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
04	**Introduction to Corporate Social Responsibility:** Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05
05	**Corporate Social Responsibility:** Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
06	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**

3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by BidyutChakrabarty, Routledge, New Delhi.

Course Code	Course Name	Credits
ILO8026	Research Methodology	03

Objectives:

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

Outcomes: Learner will be able to…

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

Module	Detailed Contents	Hrs
01	**Introduction and Basic Research Concepts** **1.1** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle.Research methods vs Methodology **1.2** Need of Research in Business and Social Sciences **1.3** Objectives of Research **1.4 Issues** and Problems in Research **1.5** Characteristics of Research:Systematic, Valid, Verifiable, Empirical and Critical	**09**
02	**Types of Research** **2.1**. Basic Research **2.2**. Applied Research **2.3.** Descriptive Research **2.4.** Analytical Research **2.5**. Empirical Research **2.6** Qualitative and Quantitative Approaches	**07**
03	**Research Design and Sample Design** **3.1** Research Design – Meaning, Types and Significance **3.2** Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	**07**
04	**Research Methodology** **4.1** Meaning of Research Methodology **4.2**. Stages in Scientific Research Process: **a.** Identification and Selection of Research Problem **b.** Formulation of Research Problem **c.** Review of Literature **d.** Formulation of Hypothesis **e.** Formulation of research Design **f**. Sample Design **g.** Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation of Data **j.** Preparation of Research Report	**08**
05	**Formulating Research Problem** **5.1** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**04**
06	**Outcome of Research** **6.1** Preparation of the report on conclusion reached	**04**

	6.2 Validity Testing & Ethical Issues **6.3** Suggestions and Recommendation	

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education

Course Code	Course Name	Credits
ILO8027	IPR and Patenting	03

Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications

Outcomes: Learner will be able to…

1. understand Intellectual Property assets
2. assist individuals and organizations in capacity building
3. work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Detailed Contents	Hr
01	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks,Copyrights, Industrial Designs, Plant variety protection, Geographical indications,Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
02	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement **Indian Scenario of IPR:**Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
03	**Emerging Issues in IPR:**Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	05
04	**Basics of Patents:** Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07
05	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
06	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	07

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCE BOOKS:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6. LousHarns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
7. PrabhuddhaGanguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications
10. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications
11. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13. N S Rathore, S M Mathur, PritiMathur, AnshulRathi**,** IPR: Drafting,Interpretation of Patent Specifications and Claims**,** New India Publishing Agency
14. Vivien Irish, 2005, Intellectual Property Rights for Engineers,IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

Course Code	Course Name	Credits
ILO 8028	**Digital Business Management**	**03**

Objectives:

1. To familiarize with digital business concept
2. To acquaint with E-commerce
3. To give insights into E-business and its strategies

Outcomes: The learner will be able to …..

1. Identify drivers of digital business
2. Illustrate various approaches and techniques for E-business and management
3. Prepare E-business plan

Module	Detailed content	Hours
1	**Introduction to Digital Business-** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	09
2	**Overview of E-Commerce** **E-Commerce-** Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	06
3	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Application Development:** Building Digital business Applications and Infrastructure	06
4	**Managing E-Business**-Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	06
5	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	**Materializing e-business: From Idea to Realization**-Business plan preparation **Case Studies and presentations**	08

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

References:

1. A textbook on E-commerce**,** ErArunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy-A new perspective- DoI:10.1787/9789264221796-enOECD Publishing

Course Code	Course Name	Credits
ILO8029	Environmental Management	03

Objectives:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations

Outcomes: Learner will be able to…

1. Understand the concept of environmental management
2. Understand ecosystem and interdependence, food chain etc.
3. Understand and interpret environment related legislations

Module	Detailed Contents	Hrs
01	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities, Environmental issues relevant to India, Sustainable Development, the Energy scenario	10
02	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
03	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
04	Scope of Environment Management, Role and functions of Government as a planning and regulating agency Environment Quality Management and Corporate Environmental Responsibility	10
05	Total Quality Environmental Management, ISO-14000, EMS certification.	05
06	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management,**T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

Subject Code	Subject Name	Credits
AEL 801	**Automotive Workshop**	**02**

Objectives:

1. To acquaint with Vehicle maintenance practices by hands on training on actual Vehicle.
2. To familiarize with fault diagnosis techniques used in automobiles.

Outcomes: Learners will be able to

1. Draw layout of automobile workshop and its usefulness.
2. Identify the various faults in engine system on actual vehicle in workshop.
3. Perform Computerized Wheel alignment Process.
4. Perform Wheel Balancing process.
5. Perform removal and re fitting of tire using automatic tire changer.
6. Demonstrate different body repairing and re-conditioning methods.

The laboratory assignments should be based on the following:

1. Prepare a layout of an automobile repair, service and maintenance shop.
2. Prepare different statements/records required for the repair and maintenance works.
3. Prepare the list of different types of tools and instruments required for maintenance.
4. Perform Minor and major tune up activity of gasoline and diesel engines.
5. Detect faults using Fault diagnosis techniques in electrical ignition system, gasoline fuel system, diesel fuel system.
6. Identify and rectify faults in the electrical systems such as Head lights, Side of Parking lights, Electric horn system, Windscreen wiper system, Starter system and charging system.
7. Check and clean fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet).
8. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
9. Perform wheel balancing on a computerized wheel balancer.
10. Perform wheel alignment activity to set proper steering geometry.
11. Perform removal and refitting of tyre using an automatic tyre changer.

Assessment:

Term Work

Term work shall consist of minimum 8 experiments from the list, 6 assignments covering maximum portion of the syllabus (one on each module).

The distribution of marks for term work shall be as follows:

1) Laboratory work (Experiments) **: 10 marks**

2) Assignments : **10 marks**

3) Attendance (Theory and Practical) **: 05 marks**

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

End Semester Practical/Oral Examination:

1. Pair of Internal and External Examiner should conduct practical/viva based on contents Distribution of marks for practical/viva examination shall be as follows:

Practical performance	15 marks
Oral	10 marks

2. Evaluation of practical examination to be done based on the experiment performed and the output of the experiment during practical examination

Students work along with evaluation report to be preserved till the next examination

Subject Code	Subject Name	Credits
AEL 802	**Vehicle Dynamics Lab**	**01**

Objectives:

1. To familiarize with basic concepts of vehicle dynamics.
2. To acquaint with simulation process using software in domain of vehicle dynamics.

Outcomes: Learners will be able to

1. Plot performance characteristic curves for shock absorber.
2. Simulate ride behaviour using quarter car model
3. Simulate ride behaviour using half car model
4. Simulate using different road profiles for quarter car and half car model.
5. Calculate drag coefficient for different vehicles
6. Perform test on chassis dynamometer.

List of Experiments:

1. To plot characteristic curves for shock absorber.
2. Simulation of Quarter car model for pitch and bounce.
3. Simulation of Quarter car model for different road profiles
4. Simulation of Half car model for pitch and bounce.
5. Simulation of Half car model for different road profiles.
6. Experimental studies of measurements of drag and lift coefficient for different geometry vehicle using wind tunnel apparatus.
7. To perform test on chassis dynamometer.

Term Work:

Term work shall consist of 7 experiments from the list, 6 assignments covering maximum portion of the syllabus (one on each module).
The distribution of marks for term work shall be as follows:

1) Laboratory work (Experiments) **: 10 marks**
2) Assignments/Mini Project : **10 marks**
3) Attendance (Theory and Practical) **: 05 marks**

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

End Semester Practical/Oral Examination:

1. Pair of Internal and External Examiner should conduct practical/viva based on contents Distribution of marks for practical/viva examination shall be as follows:

   Practical performance 15 marks
   Oral 10 marks

2. Evaluation of practical examination to be done based on the experiment performed and the output of the experiment during practical examination

Students work along with evaluation report to be preserved till the next examination

Course Code	Course Name	Credits
AEP701/ AEP801	**Project (I and II)**	**03 + 06**

Objectives:

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of solving the problem in a group
3. To acquaint with the process of applying basic engineering fundamental in the domain of practical applications
4. To inculcate the process of research

Outcomes: Learner will be able to…

1. Do literature survey/industrial visit and identify the problem
2. Apply basic engineering fundamental in the domain of practical applications
3. Cultivate the habit of working in a team
4. Attempt a problem solution in a right approach
5. Correlate the theoretical and experimental/simulations results and draw the proper inferences
6. Prepare report as per the standard guidelines.

Guidelines for Project

Students should do literature survey/visit industry/analyse current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor

Students should use multiple literatures and understand the problem.

Students should attempt solution to the problem by experimental/simulation methods.

The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Project I

Project I should be assessed based on following points

1. Quality of problem selected
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to the specialization
4. Clarity of objective and scope
5. Breadth and depth of literature survey

Project I should be assessed through a presentation by the student project group to a panel of Internal examiners appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Project II

Project II should be assessed based on following points

1. Quality of problem selected
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to the specialization / Industrial trends
4. Clarity of objective and scope
5. Quality of work attempted
6. Validation of results
7. Quality of Written and Oral Presentation

Report should be prepared as per the guidelines issued by the University of Mumbai.

Project II should be assessed through a presentation by the student project group to a panel of Internal and External Examiners approved by the University of Mumbai

Students should be motivated to publish a paper based on the work in Conferences/students competitions

Project Report has to be prepared strictly as per University of Mumbai report writing guidelines.