UNIVERSITY OF MUMBAI

Bachelor of Engineering

Mechanical Engineering

Third Year (Sem. V & VI) and Final Year (Sem. VII & VIII)

Revised Syllabus (REV- 2012) w. e. f. Academic Year 2014 - 15 and 2015-2016 respectively

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

Deans 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 (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes 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 and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande
Dean,
Faculty of Technology,
Member - Management Council, Senate, Academic Council
University of Mumbai, Mumbai

Chairman 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 University of the Mumbai, I am happy to state here that, the Program Educational Objectives were finalized in a brain storming session, which was attended by more than 20 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 prepare the Learner to use modern tools effectively in order to solve real life problems.
3. To prepare the Learner for a successful career in Indian and Multinational Organisations and to excel in their Postgraduate studies.
4. To encourage and motivate the Learner in the art of self-learning.
5. To inculcate a professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's thought process.

In addition to the above, 2 to3 more program educational objectives of their own may be added by affiliated Institutes.

In addition to Program Educational Objectives, for each course of undergraduate program, objectives and expected outcomes from the point of view of a learner 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 stake holders.

Dr. S. M. Khot

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

B. E. Mechanical-(Semester VII)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
MEC701	Machine Design -II	4	2	4	1	5
MEC702	CAD/CAM/CAE [&]	4	2	4	1	5
MEC703	Mechanical Utility Systems	4	2	4	1	5
MEC704	Production Planning and Control	4	2	4	1	5
MEE701X	Elective- I	3	2	3	1	4
MEP701	Project- I	--	6[#]	--	3	3
Total		**19**	**16**	**19**	**8**	**27**

Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
MEC701	Machine Design- II	20	20	20	80	03	25	25	150
MEC702	CAD/CAM/CAE[&]	20	20	20	80	03	25	25	150
MEC703	Mechanical Utility Systems	20	20	20	80	03	25	--	125
MEC704	Production Planning and Control	20	20	20	80	03	25	25*	150
MEE701X	Elective -I	20	20	20	80	03	25	--	125
MEP701	Project- I	--	--	--	--	--	50	--	50
Total		**--**	**--**	**100**	**400**	**--**	**175**	**75**	**750**

[&] Common with Automobile Engineering *** Only ORAL examination based on term work and syllabus**

B. E. Mechanical-(Semester VIII)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
MEC801	Design of Mechanical Systems	4	2	4	1	5
MEC802	Industrial Engineering and Management	4	2	4	1	5
MEC803	Refrigeration and Air Conditioning	4	2	4	1	5
MEE802X	Elective- II	3	2	3	1	4
MEP802	Project- II	--	12[#]	--	6	6
Total		**15**	**20**	**15**	**10**	**25**

Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
MEC801	Design of Mechanical Systems	20	20	20	80	03	25	25	150
MEC802	Industrial Engineering and Management	20	20	20	80	03	25	--	125
MEC803	Refrigeration and Air Conditioning	20	20	20	80	03	25	25	150
MEE802X	Elective -II	20	20	20	80	03	25	--	125
MEP802	Project- II	--	--	--	--	--	50	100	150
Total		**--**	**--**	**80**	**320**	**--**	**150**	**150**	**700**

* Only ORAL examination based on term work and syllabus

# indicates work load of Learner (Not faculty) in VII and VIII semester for Project

Course codes	**Elective I**	Course codes	**Elective II**
MEE7011	Product Life Cycle Management (PLM)	MEE8021	Micro Electro Mechanical Systems (MEMS)
MEE7012	Power Plant Engineering [&]	MEE8022	Renewable Energy Sources
MEE7013	Energy Management	MEE8023	Project Management [&]
MEE7014	Supply Chain Management [&]	MEE8024	Business Process Reengineering
MEE7015	Computational Fluid Dynamics [&]	MEE8025	Cryogenics
MEE7016	Advanced Turbo Machinery	MEE8026	Automobile Engineering
MEE7017	Piping Engineering	MEE8027	Process Equipment Design
MEE7018	Emission and Pollution Control	MEE8028	Alternative Fuels
MEE7019	Operations Research	MEE8029	Enterprise Resource Planning
MEE70110	Total Productive Maintenance (TPM)	MEE80210	World Class Manufacturing [&]
MEE70111	Robotics	MEE80211	Nanotechnology
MEE70112	Digital Prototyping for Product Design –I	MEE80212	Digital Prototyping for Product Design –II

[&] Common with Automobile Engineering

Course Code	Course/Subject Name	Credits
MEE 8022	**Renewable Energy Sources**	**3+1**

Objectives

1. Study working principles of various renewable energy sources and their utilities
2. Study economics of harnessing energy from renewable energy sources

Outcomes: Learner will be able to…

1. Demonstrate need of different renewable energy sources and their importance
2. Calculate and analyse utilization of solar and wind energy
3. Illustrate design of biogas plant
4. Estimate alternate energy sources India

Module	Detailed Contents	Hrs.
01	**Introduction to Energy Sources**: Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.	04
02	**Solar Energy**: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.	06
03	**Wind Energy**: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of Aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.	08
04	**Energy from Biomass**: Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	06
05	**Geothermal Energy**: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India. **Energy from the ocean**: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy	08
06	**Energy Management**: Energy economics, energy conservation, energy audit, general concept of total energy system, scope of alternative energy system in India.	04

List of Experiments

1. Demonstration of solar collector for air/water heating
2. Visit to wind farm/biogas plant

Term Work

Term work shall consist of experiments from the list, 5 assignments covering maximum portion of the syllabus and a report on factory visit

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

- Laboratory work (Experiments) **:** **05 marks**
- Assignments : **10 marks**
- Visit report: **05 marks**
- 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.

Internal Assessment

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 40% of curriculum) and the other is either a class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Theory Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
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 other than module 3)
4. Total four questions need to be solved.

References

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill
3. Solar Engineering of Thermal processes, J.A.Duffie and W.A.Beckman, 2nd edition, John Wiley, New York, 1991.
4. Fuel Cells by Bockris and Srinivasan; McGraw Hill.
5. Solar Energy: Fundamentals and Applications by H.P. Garg& Jai Prakash, Tata McGraw Hill.
6. Wind Power Technology, Joshua Earnest, PHI Learning, 2014
7. Non Conventional Energy Resources by S. Hasan Saeed and D. K. Sharma, S. K. Kataria& Sons.
8. Renewable Energy Sources, J W Twidell& Anthony D. Weir. ELBS Pub.
9. Energy Conversion Systems, R D Begamudre, New Age International (P) Ltd., Publishers, New Delhi ,2000.
10. Principles of Solar Engineering, D.Y.Goswami, F.Kreith and J.F.Kreider, Taylor and Francis, Philadelphia, 2000.
11. Solar Photovoltaics: Fundamentals, Technologies and Applications, C S Solanki, 2nd Edition, PHI Learning, 2013
12. Biomass Regenerable Energy, D. D. Hall and R. P. Grover, John Wiley, New York,1987.
13. Wind and Solar Power Systems, Mukund R Patel, CRC Press, 1999.
14. Wind Energy Explained: Theory, Design and Application, J F Manwell, J.C.McGowan, A.L.Rogers, John Wiley and Sons, May 2002.
15. Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison.