HITEC UNIVERSITY

Taxila Cantt

SELF ASSESSMENT REPORT

PhD Mechanical Engineering

Faculty of Engineering and Technology

Heavy Industries Taxila Education City (HITEC) University

May 2023

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Executive Summary

This self-assessment report is being prepared for PhD Mechanical Engineering from the Department of Mechanical Engineering as prescribed by Higher Education Commission. Quality Enhancement Cell was formed in HITEC University in 2011. Program Team and Assessment Team of mechanical engineering department were formulated by University to collaborate with QEC to accomplish the following report in line with HEC guidelines with the support of Vice Chancellor and Department Heads.

This self-assessment report provides an analysis and evaluation of the academic standards followed and implemented by PhD Mechanical Engineering Program. HEC prescribed Self-Assessment Manual is used as a reference and he program is being evaluated based on 8 criteria and 31 standards of quality improvement. First Program teams of Mechanical Department made the report and then further assessed by the assessment team. The report finds the prospects of maintaining and continually enhancing academic standards and student's learning.

This report also investigates the strong and weak areas and other improvements needed by the department. A feedback is then provided in the form of corrective actions and implementation plan for quality assurance and improvement of academic programs in the future.

Objectives

- To document the entire program into one report for the purpose of accountability, quality enhancement and accreditation.
- To make aware all the stake-holders their rights and duties as per the Self-Assessment Manual.
- To be eligible for HEC funding proportionate to our ranking.
- To be a preference for HEC scholarships for students and faculty.
- To be eligible for evaluation by external evaluators

Execution

The hierarchy of the execution tree was fundamental to the efficient working of all the stake-holders. Formulation of PT and AT was the very first step towards the goal.

Self-Assessment Manual was distributed to all the faculty members for awareness and especially to the Program and Assessment Teams for SAR. Lectures and workshops were arranged for senior faculty members along with the Registrar, Treasurer, Controller of Examination, Deans and Vice-Chancellor where qualified professionals of their fields taught the role of Quality and Accountability in education and especially in Higher Education.

The senior faculty members then became mentors for the junior faculty members and the knowledge of the subject spread to each and every faculty member along with supporting individuals/groups, until all were on the same page.

Following the lecturing and mentoring, a task distribution seminar was arranged by the chair of the Program Team. In this seminar, 8 criteria with 31 standards in total were distributed as tasks to various faculty members. An internal deadline of one month was given to all the task holders.

All task holders were instructed on the procedure of procurement of information for the completion of tasks. The information from various concerned departments of the university was to be obtained in written form along with initials of the information provider.

Once the criteria were ready, the task holder sent the soft copy for review and proof reading to the chair of the Program Team. The chair reviewed and proof read in company with the Quality Representative of the respective Department. Once all the corrections and revisions were done in line with the Self-Assessment Manual, the task holders sent a signed hard copy and a soft copy to the chair of the Program Team who then incorporated the finished criteria into a single report and the report was given a draft shape.

This draft was then sent as a soft copy and as a hard copy to the Quality Enhancement Cell, Chairman Mechanical Engineering Department, Dean and Vice-Chancellor who gave their valuable inputs.

Once the draft was finalized, QEC arranged for the Self-Assessment Report of the PhD Mechanical Engineering Program to be assessed by the Assessment Team in the first week of June 2023.

The findings of the Assessment Team (AT) are given in the annexure-G. It outlines the improvements required in the infrastructure, syllabi and training of the faculty and support staff. The implementation plan (annexure-H) was prepared after discussion with all the stake-holders and it indicates the resources required to improve the Quality. Responsible bodies, timelines and goals were set for the execution of the implementation plan.

Self-Assessment Report

Introduction

Heavy Industries Taxila Education City (HITEC) University is a private sector university. It was established in 2007 and chartered in 2009 by the Government of Punjab. The University is sponsored by Heavy Industries Taxila Education Welfare Trust (HITEWT). The university was established with a vision to produce skilled, moral, ethical and patriotic professionals who can serve the society and who will be guardians of national, social and religious values.

University Mission Statement

HITEC University will be a center of excellence in teaching, learning and research. We shall instill and inspire intellectual curiosity, lifelong quest of knowledge and a keen urge for social and moral responsibility. The University will establish strong linkages with industry ensuring innovative research leading to economic prosperity of Pakistan.

Department of Mechanical Engineering

Department of Mechanical Engineering is currently running with the first intake in 2010.

Program Selected

HITEC University has selected the **PhD Mechanical Engineering Program** as first model program for Self-Assessment Report (SAR) under the directives of Higher Education Commission (HEC). The selected program has been accredited by Pakistan Engineering Council (PEC) since 2009.

Program Evaluation

The program is being evaluated based on 8 criterion and 31 standards as given in the Self-Assessment Manual provided by Higher Education Commission (HEC).

Criterion 1: Program Mission, Objectives and Outcomes

Standard 1-1 The program must have documented measurable objectives that support institution mission statements.

Program Mission Statement

PhD Mechanical Engineering Program focuses on producing higher qualified engineers in specialized areas like Thermofluids, Design, Mechanics, Manufacturing systems and optimization. The students are offered state of the art advanced courses to equip them for solving the problems being faced in the industry. The course work also emphasizes risk-reduction, safe professional practices embodying societal and environmental concerns.

Program Objectives

To produce PhD qualified Mechanical Engineers with following attributes:

1. Possessing wider and deeper knowledge in Mechanical Engineering.
2. To be able to improve the engineering practices in vogue in the industry they have joined.
3. To be able to create innovative solutions to complex engineering problems in their respective organizations keeping in view societal and environmental concerns.

Curriculum Design

Curriculum of PhD Mechanical Engineering is carefully designed for a three and a half year degree program. The program comprises minimum 18 credit hours of graduate level course work and 30 credit hours of research thesis, fully adhering to the Higher Education Commission and Pakistan Engineering Council's guidelines and requirements. Research topics for PhD students pertain to Composite Materials, Advanced Mechanics of Materials, ThermoFluids, Computational Fluid Dynamics, Manufacturing Systems, Robotics and Renewable Energy, Vibration Analysis etc.

Program Objectives Assessment

Objective	How Measured	When Measured	Improvement Identified	Improvement Made

1	Student Exit Survey	Not Yet	Some new topics have been added	Yes
2	Alumni Survey Employer Survey	Not Yet	Survey questions have been improved	Yes
3	Alumni Survey Employer Survey	Not Yet	Survey questions have been improved	Yes
4	Alumni Survey	Not Yet	Mathematics course has been introduced	Yes

Table 1: Program Objectives Assessment

Standard 1-2 The program must have documented outcomes for graduating students. It must be demonstrated that the outcome support the program objectives and that graduating students are capable of performing these outcomes.

Program Outcomes

1. Students shall possess required pre-requisites for admission to higher degrees in reputable universities.
2. Students shall have required applied and practical knowledge and skills to pursue professional jobs in industries, laboratories, consultancy firms and government sectors.
3. Students shall be well-rounded not only in the discipline of Mechanical Engineering but also in related inter-disciplinary fields of science and technology.
4. Students shall possess sufficient knowledge to pursue an academia job.
5. Students shall be well-versed in modern day technologies in the field of Mechanical Engineering and in related disciplines. They shall be able to apply computing knowledge, IT skills, design and analysis software, probabilistic/statistical tools to not only solve technical problems but also to design new solutions and be innovative.
6. Students shall be able to become entrepreneurs in their fields of interest. They shall possess leadership, decision making and risk-taking qualities necessary to

compete, lead and succeed in a hugely competitive market. They shall possess problem solving skills and innovative ideas to be unique.

7. Students shall treat fairly all persons regardless of race, religion, gender, disability, age or regional origin. Students shall avoid conflicts at work places.

Program Objectives	Program Outcomes						
	1	2	3	4	5	6	7
1	x	x	x				
2			x	x	x	x	
3				x	x	x	x

Table 2 : Outcomes versus Objectives

Standard 1-3 The results of Program's assessment and the extent to which they are used to improve the program must be documented.

The program assessment has been done by students evaluating the courses and the respective teachers as per the HEC Performa.

See Annexure D (Teachers Evaluation Survey) for teacher's evaluation Performa and the standards against which the students have evaluated them. Updated form is also attached as some changes are being made to the form. The total graded marks are 5.

HITEC University and especially the Mechanical Engineering department has a strong tradition of quality enhancement through students' feedback. The teachers' and courses' evaluation is given due respect, analysis and direction. Teachers with strong feedback are appreciated and teachers with poor feedback are counseled, heard and encouraged. The course feedback is a major source of inspiration for curriculum and syllabi revision.

Program strengths

- Rigorous, intensive and rewarding program
- Capable faculty
- Program weaknesses
- Insufficient infrastructure

- Low number of industry-oriented courses
- Low number of design competitions and intra-university linkages

Standard 1-4 The department must assess its overall performance periodically using quantifiable measures.

Graduates/Undergraduates enrolled in last three years

Enrolled Students			
Program	**2020-21 (July 20-June 21)**	**2021-22 (July 21-June 22)**	**2022-23 (July 22-June 23)**
PhD Mechanical Engineering	2	7	6

Graduated Students			
Program	**2020-21 (July 20-June 21)**	**2021-22 (July 21-June 22)**	**2022-23 (July 22-June 23)**
PhD Mechanical Engineering	0	0	1

Student Faculty Ratio:

PhD Mechanical Engineering has Student Faculty ratio of 0.5:1

Average GPA per semester:

Average GPA per semester for the batch enrolled in year 2021-22 is as under:

Average GPA: 3.45
Average CGPA: 3.31

Average Completion time

The average completion time for PhD Program is 3.5 years and the maximum permitted time is 8 years.

Employer Satisfaction

No Employer survey of PhD program has been conducted yet. Employer survey will be conducted in Fall 2023.

Students Course Evaluation Rate

Average student evaluation for all courses is 4.26 which is very good by any measure.

Students Faculty Evaluation

The student faculty evaluation has been taken in Fall 2020 semester. The Department and QEC has planned to conduct this survey in Spring 2023 semester and onwards.

Research

The program faculty published research papers in different journals. List attached in Annexure A.

Community Service

HITEC university's students and faculty actively partakes in social welfare and community services. Be it floods or earthquakes or be it blood donation, HITEC University is always at the fore-front of giving back to the community.

Criterion 2: Curriculum Design and Organization

Title of Degree Program

PhD Mechanical Engineering

Definition of credit hour:

One credit hour is 3 hours of theory lecture in a week.

Degree plan

Following is the list of courses taught in the selected program. Section 4.5 shows the details about these courses including pre-requisites.

Table 3: Courses and their Respective Course Codes

S. No.	Course Code	Course Title	Cr. Hrs.
1	**ME-811**	Finite Element Analysis	**3 + 0**
2	**ME-812**	Advanced Material Science and Engineering	**3 + 0**
3	**ME-813**	Advanced Solid Mechanics	**3 + 0**

4	**ME-815**	Advanced Theory of Elasticity	**3 + 0**
5	**ME-816**	Advanced Thermodynamics	**3 + 0**
6	**ME-818**	Advanced Fluid Mechanics	**3 + 0**
7	**ME-819**	Computational Fluid Dynamics	**3 + 0**
8	**ME-820**	Experimental Stress Analysis	**3 + 0**
9	**ME-823**	Manufacturing System	**3 + 0**
10	**ME-824**	Advanced Robotics	**3 + 0**
11	**ME-829**	Engineering Design and Optimization	**3 + 0**
12	**ME-830**	Mechanics of Composite Materials	**3 + 0**
13	**ME-831**	Fracture Mechanics	**3 + 0**
14	**ME-832**	Advanced Dynamics	**3 + 0**
15	**ME-835**	Theory of Plates and Shell	**3 + 0**
16	**ME-837**	Radiation Heat Transfer	**3 + 0**
17	**ME-838**	Advanced Heat Transfer	**3 + 0**
18	**ME-839**	Theory of Turbo Machinery	**3 + 0**
19	**ME-840**	Gas Dynamics	**3 + 0**
20	**ME-841**	Advanced Mechanical Behavior of Materials	**3 + 0**
21	**ME-842**	Finite Element Analysis of Composite Materials	**3 + 0**
22	**ME-843**	Advanced Refrigeration	**3 + 0**
23	**ME-844**	Design of Thermal System	**3 + 0**
24	**ME-860**	Solar Thermal Systems	**3 + 0**
25	**ME-861**	Boundary layer Flows	**3 + 0**
26	**ME-862**	Introduction to Turbulent Flows	**3 + 0**
27	**ME-863**	Mechanics of Manufacturing Processes	**3 + 0**
28	**ME-865**	Advanced Control Systems	**3 + 0**
29	**ME-866**	Design of Manufacturing and Assembly	**3 + 0**
30	**ME-867**	Sustainable Renewable Energy Systems	**3 + 0**
31	**ME-868**	Advanced Mechanical Vibrations	**3 + 0**
32	**ME-869**	Flow Induced Vibrations	**3 + 0**
33	**ME-870**	Additive Manufacturing	**3 + 0**
34	**MT-839**	Advanced Numerical Techniques	**3 + 0**
35	**ME-900**	Special Topics	**9 + 0**

Courses Information

ME- 811: Finite Element Analysis

Introduction to FEA, fundamental concept (strong, weak forms, Matrix Forms). Stiffness matrix: linear spring system with examples in structural, fluid and thermal systems, 1D linear and quadratic Shape functions. Bar elements: trusses. Beam Element: beams and frames with different type of loading and constraints. 2D Element: linear triangular element with application on plates.

ME- 812: Advanced Materials Sciences and Engineering

Elasticity, nonlinearity in crystalline materials, pseudo-elasticity, rubber elasticity, visco-elasticity: elasticity and fluidity, plasticity, limit of elastic response, mechanism in crystalline materials and non-crystalline materials, creep, deformation mechanism maps for elasto-plasticity, fracture due to fatigue.

ME- 813: Advanced Solid Mechanics

Fundamental concept of structural mechanics with application to mechanical engineering, residual stresses, thermal effects, analysis of beams and columns, tensioned beams, trusses, frames, cables and shafts of general material and shape, elastic buckling of columns, energy methods, principle of virtual work, introduction to computational structural mechanics.

ME- 815: Advanced Theory of Elasticity

Analysis of stress and strain in two- and three-dimensions, equilibrium and compatibility equations, plane stress and plane strain analysis and applications, stress strain and strain displacement relations in 3D, two-dimensional problems in polar coordinates, general equations in polar coordinates, strain- displacement relations, compatibility equation, and stress-strain relations, axisymmetric problems, thick- walled cylinders, rotating disks of uniform thickness, governing equations for symmetric bending of circular plates, thermal stresses in cylinders and disks.

ME- 816: Advanced Thermodynamics

This course provides a more advanced study of engineering thermodynamics. Includes an examination of the fundamental concepts of classical, macroscopic thermodynamics at a level beyond what is covered in a first course. Coverage includes additional advanced topics such as availability (exergy), equations of state, property relationships, and mixture properties. An introduction to the microscopic aspects of thermodynamics will provide a foundation for understanding the principles of statistical thermodynamics

ME- 818: Advanced Fluid Mechanics

Introduction, kinematics, Rayleigh problems, boundary layer separation and drag, one dimensional compressible flow, steady supersonic two-dimensional flow, linearized flow, viscous flow, introduction to turbulence, turbulence modeling.

ME- 819: Computational Fluid Dynamics

Introduction, partial differential equations, basics of finite difference methods, concept of error, consistency and stability, momentum and energy equations, diffusion equations, turbulence modeling, boundary layer computational methods, hyperbolic equations, grid systems.

ME- 820: Experimental Stress Analysis

Review of elementary elasticity, that includes laws of stress transformation, principal stresses and principal strains, equations of equilibrium, Mohr's stress circle, construction of Mohr Circle for two and three dimensional stress-strain systems, stress concentration points, strain-measurement method and related instrumentation using electrical resistance strain gauges, optical methods of stress analysis, using photo elasticity, laboratory sessions on electrical resistance strain gages and polariscope.

ME- 823: Manufacturing Systems

This course focuses on important issues in the design and operation of manufacturing systems and gives some intuition about behavior of these systems. Topics include material handling, material transport system, storage systems, components and

classification of manufacturing systems, group technology, cellular manufacturing, flexible manufacturing systems, assembly lines and manufacturing support systems.

ME- 824: Advanced Robotics

Robot programming languages, introduction to mobile robots, motion planning, grasp kinematics, manipulation and grasp planning, robot intelligence, special robot mechanisms.

ME- 829: Engineering Design & Optimization

This course focuses on the application of optimization techniques for engineering design. Topics include design problem formulation, graphical optimization, optimum design concepts, unconstrained optimization, constrained optimization using KKT conditions, linear programming using SIMPLEX method, numerical methods for optimization and nontraditional/modern optimization algorithms like genetic algorithms and particle swarm optimization etc. Introduction to multivariable optimization along with use of MATLAB for optimization.

ME- 830: Mechanics of Composite Materials

Introduction, mechanics of unidirectional ply, mechanics of composite lamina, mechanics of laminate (laminate theory), failure criteria of composite materials, design problems, FEA of composite materials.

ME- 831: Fracture Mechanics

Theory of elasticity, introduction to fracture mechanics, linear elastic fracture mechanics, elastic field equations, crack tip plasticity, the energy principle, plastic fracture mechanics, mixed-mode fracture mechanics, fatigue crack growth, fracture toughness correlations.

ME- 832: Advanced Dynamics

Kinematics and kinetics of plane and three-dimensional motion, general methods of linear and angular momentum, relative motion, central force motion, coriolis acceleration, gyro-dynamics, generalized coordinates and constraints, principle of virtual work and D'Alembert's principle, Hamilton's principle, Lagrange equations, Raliegh-Ritz method, stability of dynamic systems.

ME- 835: Theory of Plates and Shells

Vector, tensor and equation of elasticity, energy principles and variational methods, classical theory of plates, circular plates, buckling of plates, theory and analysis of shells.

ME- 837: Radiation Heat Transfer

Fundamental of thermal radiation, view factors and relation, black surfaces, gray surfaces, radiations shields and its effects, radiation exchange with emitting and absorbing gases.

ME- 838: Advanced Heat Transfer

Introduction, general heat transfer equation in rectangular, cylindrical and spherical coordinate system, steady (2- D and transient (1-D) analysis, analytical, numerical and graphical methods to solve heat transfer equation, convection equation (mass, momentum and energy), laminar and turbulent heat transfer, free and forced convection (internal and external flows).

ME- 839: Theory of Turbo-machinery

The course aims at giving an overview of different types of turbo-machinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic, steam and gas –turbines, working principles of turbo-machines and apply it to various types of machines, velocity triangles in turbo-machinery stages operating at design and off-design conditions, perform the preliminary design of turbo-machines (pumps, compressors, turbines) on a 1-D basis, characterization turbo-machinery stages, off-design behavior of turbines and compressors and relate it to changes in the velocity triangles.

ME- 840: Gas Dynamics

Fluid flow and thermodynamics of gases, control volumes, vector calculus, equations of motion, gas dynamics of nozzles, steady and unsteady waves, oblique shocks, Prandtl-Meyer expansion, linearized potential flow, thin airfoil theory.

ME- 841: Advanced Mechanical Behavior of Materials

Stress and strain, isotropic and anisotropic Elasticity, tensile testing, strain-hardening of metals, plasticity theory, slip, dislocation geometry and energy, dislocation mechanics, fracture mechanics, creep and stress rupture, fatigue for modeling composites, elasticity and strength of laminates, buckling, free edge stresses, computational micromechanics, analytical homogenization, numerical homogenization, local-global analysis (sub-modelling), laminated RVE, viscoelasticity, damage mechanics.

ME-842: Finite Element Analysis of Composite Materials

Mechanics of orthotropic materials, Introduction to finite element methods, choice of abstraction level for modeling composites, elasticity and strength of laminates, buckling, free edge stresses, computational micromechanics, analytical homogenization, numerical homogenization, local-global analysis (sub-modelling), laminated RVE, viscoelasticity, damage mechanics.

ME- 843: Advanced Refrigeration

Review of thermodynamics and heat transfer, methods of producing cold, thermodynamic modeling and parametric analysis of simple and multi-pressure vapor compression refrigeration, cascade systems, cryogenics, thermodynamic analysis of absorption refrigeration systems: water-libr absorption refrigeration (single and double effect), water-NH_3 absorption refrigeration (single and double effect), adsorption refrigeration, solar based absorption/ adsorption refrigeration, compressors, expansion devices, condensers and evaporators, cooling towers and evaporative coolers, vortex tube refrigeration, thermoelectric refrigeration.

ME- 860: Solar Thermal Systems

Introduction to solar energy, physics of the sun and its energy transport, thermal radiation fundamentals, sun earth geometric relationship, solar radiation, angles for tracking surfaces, beam and diffuse components of solar radiation, surface tilt, shadow determination, extraterrestrial and terrestrial Irradiation, radiation on sloped surfaces, optical properties of cover systems, reflection of radiation, absorption by glazing, transmittance-absorption product, absorbed solar radiation, measuring solar radiation, components of solar thermal systems, description of flat-plate collectors, basic flat-plate energy balance equation, collector overall heat loss coefficient, collector heat removal factor and flow factor, liquid heater plate geometries, air heaters, measurements of collector performance, collector characterizations, sizing of a collector for an application, description of concentrating collectors and configurations, thermal and optical

performance of concentrating collectors, solar water heating and air-conditioning systems, other potential solar thermal applications.

ME- 861: Boundary Layer Flows

The transport equations of mass, momentum and energy for flows with viscosity and heat conduction, molecular transport properties, Navier-Stokes equations, boundary layer simplifications, Incompressible laminar flows, exact solutions, self-similar and non-similar boundary layers, numerical calculation methods, Approximate (integral) methods for boundary layer computations. Internal flows, flow over surfaces, jets, rotating elements, and the effects of compressibility.

ME -862 Introduction to Turbulent Flows:

Introduction, Experimental techniques for turbulent flows, Equations governing turbulent flows, Benchmark data and features of basic turbulent flows, Turbulence modeling, Numerical scheme for prediction of thin shear flows, Numerical scheme for prediction of separated flows, Introduction to Large Eddy Simulation (LES), Elements of Direct Numerical Simulation (DNS).

ME -863 Mechanics of Manufacturing Processes:

Basics of Materials Behavior, Orthogonal cutting model in machining, cutting conditions in operations, forces in metal cutting & surface finish, grinding analysis, cutting tools and technology, non-conventional machining processes, analysis of plastics extrusion, bulk deformation and analysis of open die forging, flat rolling & metallic extrusion, drawing analysis, engineering analysis of sheet metal, engineering analysis of pouring, collector overall heat loss coefficient, collector heat removal factor and flow factor, liquid heater plate geometries, air heaters, measurements of collector performance, collector characterizations, sizing of a collector for an application, description of concentrating collectors and configurations, thermal and optical performance of concentrating collectors, solar water heating and air-conditioning systems, other potential solar thermal applications.

ME- 865 Advanced Control Systems:

Frequency response analysis, Design with PID controller, Pole-assignment controller design, State-space modeling, Controllability, Observability, Linearization of nonlinear systems, Introduction to Robustness, Lyapunov stability concepts, Linear Quadratic Regulator (LQR), Overview of Kalman filter theory.

ME-866: Design for Manufacture and Assembly

Product Design Basics: Modern Product Development, Functional Modeling of the Product, Product Architecture. Design for Manufacture and Assembly (DFMA): Concept Generation and selection, DFMA Guidelines, Material selection and processes. Design for Manufacture (DFM): Design for Machining, Design for Injection Moulding, Design for Sheet Metal Forming, Design for Castings. Design for Forgings, Design for Assembly (DFA):Product Design for manual assembly, Design for high speed automated assembly. Geometric Dimensioning and Tolerances (GD & T):Dimension tolerances control frames, Form Tolerances, Orientation Tolerances. Robust Designing, Factorial Analysis, Taguchi Method

ME-867 Sustainable Renewable Energy Systems

Introduction to Sustainable Energy and Renewable Energy Technologies, Minimizing CO2 Emissions, Solar Photovoltaic Energy Systems, Solar Thermal Energy Systems,

Wind Energy Systems, Hydro Energy Systems, Tidal Wave Energy Systems, Biomass Energy Systems.

ME- 868: Advanced Mechanical Vibrations

Stress and Strain, Elasticity, Tensile Testing, Strain-Hardening of Metals, Plasticity Theory, Slip, Dislocation Geometry and Energy, Dislocation Mechanics, Fracture Mechanics

ME-869: Flow Induced Vibrations

Introduction to Flow Induced Vibrations (FIV), Dimensional Analysis, Modeling of Ideal Fluid, Fundamental of potential flow, Added mass, Fluid Coupling, Types of Excitation Mechanisms, Introduction of Galloping and Flutter, Prevention of galloping and flutter instability, Vibration Instability of different structures (Tubes and cylinder arrays, Pipes carrying fluid), Damping in engineering structures

ME-870 Additive Manufacturing

Introduction and Basic Principles, Classification of AM Processes, Additive Manufacturing Process Chain, Materials Used in Additive Manufacturing, Photopolymerization Processes, Powder Bed Fusion Processes, Extrusion-Based Systems, Material Jetting / Binder Jetting, Directed Energy Deposition Processes, Sheet Lamination Processes, Rapid Tooling, Post-processing / Software Issues, Design for Additive Manufacturing/ Process Selection, Applications for Additive Manufacturing, Business Opportunities and Future Directions.

ME 900 Special Topics:

Due to breadth of Mechanical Engineering curriculum, there are many other topics which fall under its purview. Keeping this in view, a maximum of three courses other than those mentioned above, can be offered at MS level as Special Topics.

Standard 2-1The curriculum must be consistent and supports the program's documented objectives.

Table 4: Mapping of courses in PhD Mechanical Engineering program with program objectives

Courses/ Groups of Courses	1	2	3
Advanced Heat Transfer	✓		✓
Advanced Fluid Mechanics	✓		✓
Advanced Solid Mechanics	✓		
Finite Element Analysis	✓		✓
Advanced Thermodynamics	✓		
Computational Fluid Dynamics	✓		✓

Engineering Design and Optimization		✓	✓
Radiation Heat Transfer	✓		
Advanced Numerical Techniques			✓
Gas Dynamics	✓		
Advanced Refrigeration	✓		✓
Boundary layer Flows	✓		
Introduction to Turbulent Flows	✓		✓
Theory of Turbo Machinery	✓		
Flow Induced Vibrations	✓		✓
Advanced Dynamics	✓		✓
Advanced Robotics	✓		✓
Advanced Control Systems	✓		✓
Solar Thermal Systems	✓	✓	
Advanced Mechanical Vibrations	✓		✓
Design of Thermal System		✓	✓
Sustainable Renewable Energy Systems	✓		✓
Advanced Material Science and Engineering	✓		✓
Manufacturing System	✓	✓	
Theory of Plates and Shell	✓		
Finite Element Analysis of Composite Materials	✓		✓
Mechanics of Manufacturing Processes	✓		
Additive Manufacturing	✓		✓

Design for Manufacture and Assembly		✓	✓
Experimental Stress Analysis	✓		
Fracture Mechanics	✓		
Mechanics of Composite Materials	✓		
Advanced Mechanical Behavior of Materials	✓		
Advanced Theory of Elasticity	✓		

Standard 2-2 Theoretical backgrounds, problem analysis and solution design must be stressed within the program's core material.

Elements	Courses
Technical background	• Advanced Heat Transfer • Advanced Fluid Mechanics • Advanced Solid Mechanics • Advanced Thermodynamics • Radiation Heat Transfer • Gas Dynamics • Advanced Refrigeration • Theory of Turbo Machinery • Flow Induced Vibrations • Advanced Robotics • Advanced Control Systems • Solar Thermal Systems • Advanced Mechanical Vibrations • Design of Thermal System • Sustainable Renewable Energy Systems • Manufacturing System • Theory of Plates and Shell • Mechanics of Manufacturing Processes • Additive Manufacturing • Design for Manufacture and Assembly • Experimental Stress Analysis • Fracture Mechanics • Mechanics of Composite Materials • Advanced Mechanical Behavior of Materials • Advanced Theory of Elasticity

Problem analysis	• Advanced Heat Transfer • Advanced Fluid Mechanics • Advanced Solid Mechanics • Finite Element Analysis • Advanced Thermodynamics • Computational Fluid Dynamics • Engineering Design and Optimization • Radiation Heat Transfer • Advanced Numerical Techniques • Gas Dynamics • Advanced Refrigeration • Boundary layer Flows • Theory of Turbo Machinery • Flow Induced Vibrations • Advanced Dynamics • Advanced Robotics • Advanced Control Systems • Solar Thermal Systems • Advanced Mechanical Vibrations • Design of Thermal System • Manufacturing System • Theory of Plates and Shell • Finite Element Analysis of Composite Materials • Mechanics of Manufacturing Processes • Additive Manufacturing • Experimental Stress Analysis • Fracture Mechanics • Mechanics of Composite Materials • Advanced Mechanical Behavior of Materials • Advanced Theory of Elasticity Laser Materials Processing
Solution design	• Research Thesis / Project • Advanced Solid Mechanics • Engineering Design and Optimization • Advanced Robotics • Advanced Mechanical Vibrations • Design of Thermal System • Additive Manufacturing • Design for Manufacture and Assembly

Table 5: Standard 2-2 Requirement (table 4.5)

Standard 2-3 The Curriculum must satisfy the core requirements for the program as specified by the respective accreditation body.

PhD Mechanical Engineering program is recognized by Higher Education Commission (HEC) and accredited by the Engineering Council of the Pakistan (PEC). Minimum Requirements for each program (Program Semester Credit Hours):

Program	Theory Courses	Research Thesis
PhD Mechanical Engineering	18	30

Table 6: Program Credit Hours

Standard 2-4 The curriculum must satisfy the major requirements for the program as specified by the respective accreditation body.

Same as Standard 2-3.

Standard 2-5 The curriculum must satisfy general education, arts and professional and other discipline requirements for the program as specified by the respective accreditation body.

Same as standard 2-3 and Standard 2-1 (table 4.4) as defined above.

Standard 2-6 Information technology component of the curriculum must be integrated throughout the program

Not applicable.

Standard 2-7 Oral and written communication skills of the student must be developed and applied in the program.

Students go through course presentations and research methodology, which develop the oral and written communication skills of the students. Students have to write a thesis and present their work in thesis defense in 4th semester.

Criterion 3: Laboratories and Computing Facilities

Standard3-1 Laboratory manuals/documentation/instructions for experiments must be available and easily accessible to faculty and students.

Not applicable.

Standard 3-2 There must be support personal for instruction and maintaining the laboratories.

Not applicable.

Standard 3-3 The University computing infrastructure and facilities must be adequate to support program's objectives.

Not applicable.

Criterion 4: Student Support and Advising

Since the launch of HITEC University in year 2007, all its programs have started and finished on schedule. The beauty of the HITEC culture is that teachers and students have facility of frequent interaction, even after classes, for any professional and academic advice. This aspect is even highlighted and indicated by the students in the feedback on HEC Performa number 10, taken by the Quality Enhancement Cell (QEC) in the university.

Standard 4-1 Courses must be offered with sufficient frequency and number for students to complete the program in a timely manner.

The department circulates a list of postgraduate courses to be offered by the PhD qualified faculty. A student registers in one, two or at the most three courses. The minimum number of the students needed for offering a course is 6. The practice is followed in all the teaching semesters. Over the years, our experience shows that this scheme gives ample opportunities to complete the MS coursework in three semesters quite comfortably. The fourth semester is meant for research and writing a thesis. Thus,

an average student cannot complete all requirements for the MS degree in two years time frame.

Standard 4-2 Courses in the major area of study must be structured to ensure effective interaction between students, faculty and teaching assistants.

The department ensures that postgraduate courses are offered in well-considered chronological sequences, leading towards the assigned research projects of the students.

Standard 4-3 Guidance on how to complete the program must be available to all students and access to qualified advising must be available to make course decisions and career choices.

The department has dedicated a senior faculty member as the postgraduate advisor. He advises the students to select courses and in doing so, he consults the HOD as well as the PhD faculty. This ensures a smooth process of course selection. During the research phase, each student has a dedicated supervisor as well. He keeps guiding the students regularly till the end of the research defense.

Criterion 5: Process Control

Standard 5-1 The process by which students are admitted to the program must be based on quantitative and qualitative criteria and clearly documented. This process must be periodically evaluated to ensure that it is meeting its objectives.

Our university has a clearly defined and well documented admission process. It is as given below. The prospective candidate should have:

- MS/M Phil or equivalent (in relevant discipline) with minimum CGOA 3.00/4.00 from an HEC recognized university.
- GAT Subject test conducted by NTS with minimum 60% cumulative score or GRE Subject test with minimum 60% percentile score.

Additionally, the candidates are also interviewed. For this purpose, the department has an Admission Committee comprising HOD and at least two senior faculty members. So far, this process of admission is working to our satisfaction. However, we remain conscientious of reviewing it whenever the need would arise.

Standard 5-2 The process by which students are registered in the program and monitoring of students' progress to ensure timely completion of the program must be documented. This process must be periodically evaluated to ensure that it is meeting its objectives.

As mentioned earlier, the postgraduate program supervisor keeps track of the performance of each student and HOD also, individually, keeps a check on the progress as well. The controller of examinations department keeps in custody all the results and raises an alarm whenever a student is likely to get into difficulties situation.

Standard 5-3 The process of recruiting and retaining highly qualified faculty members must be in place and clearly documented. Also processes and procedures for faculty evaluation, promotion must be consistent with institution mission statement. These processes must be periodically evaluated to ensure that it is meeting with its objectives.

Vacant and newly created positions are advertised on the university website and also in the national newspapers, applications are received by the Registrar office, scrutinized by the respective Deans, and call letters are issued to the short-listed candidates on the basis of experience, qualification, publications and other qualities/activities as determined by the University in the light of HEC guidelines.

The candidates are interviewed by the University Selection Board. Selection of candidates is approved by the BOG. Induction of new candidates depends upon the number of approved vacancies.

Faculty members are retained by giving them good remuneration, favorable teaching environment, research facilities and management support.

On semester basis faculty performance is evaluated basing on HEC Performa number 10 by the students, HOD recommendations and with the counter signature of Dean and

Vice Chancellor. The additional annual increment is based on the recommendations of the HOD, Dean and the Vice Chancellor.

Standard 5-4 The process and procedures used to ensure that teaching and delivery of course material to the students emphasizes active learning and that course learning outcomes are met. The process must be periodically evaluated to ensure that it is meeting its objectives.

Students are the recipient of the delivery of course material, through their teachers. The program is actively evaluated by HOD, Dean, In Charge program and QEC. The feedback of the taught course is best instrument to measure that the course learning outcomes are met. The students give feedback on Performa number 1 regarding course contents and how it was delivered. Through Performa number 10, students evaluate and comment on teacher's efforts, put in to deliver the course contents, his general conduct in the class, the environment, he/she, maintains and extra efforts, he/she makes to satisfy students, thirst for knowledge.

Faculty feedback is also taken on HEC Performa number 2 (Faculty Course Review Report – Annexure C) and Performa number 5 (Faculty Survey – Annexure - E) which is a very useful activity to evaluate the course contents, learning and teaching environments and overall teachers satisfaction level. Course evaluation by teachers also indicates what percentage of desired outcome has been achieved by the course contents and what needs to be improved or changed.

This exercise is done twice a year. The feedback is discussed with HOD, Dean and In-charge program, who focus on making improvements in the weak areas, identified by the students. Teacher's evaluation Performa's are fed to the computer and bar charts are made. Each teacher is graded out of 5 marks. The comparative bar charts indicate level of performance of teachers, as visualized by the students. QEC formally submits these bar charts to HOD, Dean and Vice Chancellor for their information and taking of necessary corrective actions.

Standard 5-5	**The process that ensures that graduates have completed the requirements of the program must be based on standards, effective and clearly documented procedures. This process must be periodically evaluated to ensure that it is meeting its objectives.**

HEC criteria for enduring the fulfillment of all the requirements are strictly followed in the University for the Award of MS degree. It consists of either passing 10 postgraduate courses or 8 courses and a research thesis. Also, our requirement is that a student must achieve a minimum CGPA of 2.5 out of 4.00. The minimum duration for Masters Program is 1.5 years and the maximum permitted time is 4 years. The complete process is well documented and well publicized. The appropriateness of this process is reviewed through faculty and student feedback forms by the QEC Directorate.

Criterion 6: Faculty

Standard 6-1	**There must be enough full time faculties who are committed to the program to provide adequate coverage of the program areas/courses with continuity and stability. The interests and qualifications of all faculty members must be sufficient to teach all courses, plan, modify and update courses and curricula. All faculty members must have a level of competence that would normally be obtained through graduate work in the discipline. The majority of the faculty must hold a Ph.D. in the discipline.**

There are eleven PhD faculty members, specialist in the fields of composite materials, computational fluid dynamics, engineering software development, solid mechanics, solar thermal collectors, process planning, fluid mechanics and thermodynamics. Including these following ranks are available in the mechanical department:

- Professor – 2 (Head of Department & Dean of Faculty)
- Associate Professor – 2
- Assistant Professor – 7

Program Area of Specialization	All courses			Number of PhD faculty
Mechanical Engineering	1.	**ME-811**	Finite Element Analysis	*
	2.	**ME-812**	Advanced Material Science and Engineering	*
	3.	**ME-813**	Advanced Solid Mechanics	-
	4.	**ME-815**	Advanced Theory of Elasticity	-
	5.	**ME-816**	Advanced Thermodynamics	-
	6.	**ME-818**	Advanced Fluid Mechanics	-
	7.	**ME-819**	Computational Fluid Dynamics	-
	8.	**ME-820**	Experimental Stress Analysis	-
	9.	**ME-823**	Manufacturing System	-
	10.	**ME-824**	Advanced Robotics	-
	11.	**ME-829**	Engineering Design and Optimization	*
	12.	**ME-830**	Mechanics of Composite Materials	*
	13.	**ME-831**	Fracture Mechanics	-
	14.	**ME-832**	Advanced Dynamics	
	15.	**ME-835**	Theory of Plates and Shell	*
	16.	**ME-837**	Radiation Heat Transfer	-
	17.	**ME-838**	Advanced Heat Transfer	*
	18.	**ME-839**	Theory of Turbo Machinery	-
	19.	**ME-840**	Gas Dynamics	*
	20.	**ME-841**	Advanced Mechanical Behavior of Materials	*
	21.	**ME-842**	Finite Element Analysis of Composite Materials	*

	22.	**ME-843**	Advanced Refrigeration	-
	23.	**ME-844**	Design of Thermal System	*
	24.	**ME-860**	Solar Thermal Systems	-
	25.	**ME-861**	Boundary layer Flows	*
	26.	**ME-862**	Introduction to Turbulent Flows	*
	27.	**ME-863**	Mechanics of Manufacturing Processes	-
	28.	**ME-865**	Advanced Control Systems	-
	29.	**ME-866**	Design of Manufacturing and Assembly	-
	30.	**ME-867**	Sustainable Renewable Energy Systems	-
	31.	**ME-868**	Advanced Mechanical Vibrations	-
	32.	**ME-869**	Flow Induced Vibrations	*
	33.	**ME-870**	Additive Manufacturing	*
	34.	**MT-839**	Advanced Numerical Techniques	*
	35.	**ME-900**	Special Topics	*

* Faculty teaching other courses can also teach these courses

Table 7: Courses Taught vs. Availability of Faculty

The ratio of faculty viz-ã-viz courses being taught is satisfactory. The present faculty is in position to take up all courses of post graduate students. Each faculty member is assigned subjects along with approved syllabus at the beginning of the semester. The faculty member prepares lecture plans and delivers to his / her students. Remaining restricted to the approved syllabus, the faculty member can update the already taught subject material according to the current developments in the field. Thus students are kept updated to the latest developments. Each faculty member is assigned access to the internet. Time table is scheduled in such a way so as to provide enough time to each teacher for research work. The courses being taught and commitment of the faculty is shown in the Table 7 for prescribed regular courses.

Standard 6-2 All faculty members must remain current in the discipline and sufficient time must be provided for scholarly activities and professional development. Also, effective programs for faculty development must be in place. Effective Programs for Faculty Development

University has an efficient and committed faculty. Each faculty member is assigned to teach subjects according to the syllabus prescribed in the light of HEC and PEC directives. Every faculty member is provided an opportunity at the end of semester through faculty satisfaction report to evaluate his/her performance and comment on the suitability of the contents of curriculum being taught by him according to the latest trends / developments. If deemed necessary, suitable changes to the curricula are made by a board in the light of the suggestions of the concerned faculty member.

University encourages the researchers by providing them a nominal amount after publication of research paper. Enough time is provided to the faculty members for devoting their time to research in their fields. The faculty members are assisted by university through provision of internet facility and library.

Standard 6-3 All faculty members should be motivated and have job satisfaction to excel in their profession.

Students' feedbacks about their teachers are received after termination of each semester. Basing on these feedbacks, faculty members graded best by their students are awarded with appreciation letters. Letter of caution is served to the faculty member with whom students are not satisfied.

The faculty survey as per Performa prescribed by HEC is evaluated and basing on the inputs of the Performa, the system is further improved to provide beneficial teaching / learning environment. Faculty Surveys results are attached as per Annexure G.

Criterion 7: Institutional Facilities

Standard 7-1 The institution must have the infrastructure to support new trends in learning such as e-learning.

The university has provided e-learning facilities to faculty members and students. Students have been provided a number of computer systems in the library to access e-learning section. Every student has been provided with user ID to access the e-learning resources from within the university library. Our library hosts over 12,000 e-books on all relevant subjects.

The support staff to look after the e-learning resources is sufficient in number, trained and responsive. The university has provided enough funding to support the e-learning.

Standard 7-2 The library must possess an up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel.

Our library holds more than 21,000 titles on all relevant engineering, sciences, mathematics, and humanities subjects. We add nearly 2,000 titles every year. Our library staff members are all duly qualified in library science subjects and also help the students for searching the required material. The library also provides 22 dedicated computers which students use for web browsing.

Standard 7-3 Class-rooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibilities.

The department has ample classrooms. These are very well furnished and also contain electric heaters and air conditioners. At most every classroom has installed multimedia projector. Similarly, faculty offices are well-equipped and well-furnished.

Criterion 8: Institutional Support

Standard 8-1 There must be sufficient support and financial resources to attract and retain high quality faculty and provide the means for them to maintain competence as teachers and scholars.

University allocates enough financial resources each year to hire competent faculty as required.

As already listed in standard 5-3, Faculty members are retained by giving them favorable teaching environment and management support. Most important point is that our pay scales for faculty are highly competitive and better than most of our competing institutions, including NUST.

As listed in standard 6-2, Faculty members are provided with adequate resources for research and academic activities to maintain their competence. Faculty members have access to the internet and library materials for academic and research activities. Professional training is also provided to faculty if required to enhance their capabilities. The university has schemes in place to reward faculty for each published research paper, chapter of a book, or the complete book. Similarly, travel grants of handsome amount is available for attending a conference.

Standard 8-2 There must be an adequate number of high quality graduate students, research assistants and Ph.D. students.

The university follows the guidelines of HEC for admission in MS programs. The department has very vibrant postgraduate and doctoral programs. The university provokes its students to enhance their academic qualification. Also, all T/As and R/As are selected from our under study postgraduate students.

Standard 8-3 Financial resources must be provided to acquire and maintain Library holdings, laboratories and computing facilities.

The library holds more than 21,000 titles and 12,000 e-books. Sufficient numbers of computers are available for students. A computerized online search facility is also available.

Our laboratories are very well-equipped with the latest equipment and facilities. The university takes pride in the fact that our laboratories have been replicated by a number of other universities.

Conclusion

The self-assessment report of the Faculty of Mechanical Engineering, HITEC University, Taxila is an important document, which gives strengths and weaknesses of the program. The management is striving hard to improve infrastructure for establishment of conducive environment for studies. The faculty is focused on imparting quality education, introduction of new and innovative techniques and conduct of quality research to produce competent engineers. The report has been prepared after evaluating the program in the light of 8 criterion and 31 standards given in HEC's Self-Assessment Manual. The program mission objectives and outcomes are assessed and strategic plans are presented to achieve the goal, which are again measurable through definite standards. Students' course evaluation score ranged between 4.25 to 4.27 with a mean of 4.46 points in 0-5 scale. Alumni surveys revealed variable results with regards to knowledge, interpersonal skills, management and leadership skill. Weaknesses are identified which are related to space, laboratories and equipment. Improvements in curriculum design and infrastructure are suggested which are based upon set, well defined and approved criteria. Pre-requisites are fully observed, examinations are held on schedules, academic schemes are prepared well in advance, transparent admission, registration and recruiting policy are some of the strong areas of this program. The number of courses along with titles and credit hours for each semester, course contents for degree program, is thoroughly planned. Their efficacy was measured through different standards and it was found to be satisfactory.

Proper steps are taken to guide the students for program requirements, research work, meetings, and students-teacher interaction etc. Some improvements have been suggested. As regards the process control covering admission, registration, recruiting policy, courses and delivery of material, academic requirements, performance and grading, university, PEC as well as Higher Education Commission has set forth proper rules, which are properly followed. At present there are six faculty members who are highly qualified in their fields. However, faculty members need motivation for advanced knowledge, research and external training.

Institutional facilities were measured through Criterion 3; infrastructure, library, class room and faculty offices and in each case, short comings and limitation are highlighted. Institutional facilities need to be strengthened. Accordingly, institutional support will greatly promote and strengthen academic, research, management and leadership capabilities.

In conclusion, PhD Mechanical Engineering program is designed to educate students to meet the challenges of the modern world and present market needs. During the execution of the program several observations were made that can be categorized as strong and weak points of the program. These points are listed below:

Strong Areas

- Curriculum Design, development and organization are based upon set, well defined and approved criteria.
- Rigorous, intensive and rewarding research program.
- Capable Faculty.
- Examinations on schedule.
- Academic Schemes fully prepared in advance.
- The number of courses along with their titles and credit hours for each semester, course contents for degree program are fully planned.
- Transparent admission, registration and recruiting policy.
- PEC & HEC rules fully followed.
- Excellent Student-Teacher ratio.

Weak Areas

- Inadequate research space and facilities for students.
- Direct access of IEEE publications and digital library.

Annexure – A: Research Papers List

FACULTY PUBLICATIONS

Dr. S.KAMRAN AFAQ

Journal Papers

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Dr. Liaqat Ali

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Dr. Muhammad Zahid Iqbal Qureshi

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Dr. Syed Maaz Hasan

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Dr. Tanveer Ahmed

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Dr. Saad Arif

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Dr. Zarak Khan

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Annexure – B: Faculty Resume

S. No	Name	Designation	Qualification	Institution	Specialization	Experience (yrs.)	Utilization
						Teaching	Dedicated / Shared
1	Dr. S. Kamran Afaq	Professor	PhD	University Paul Sabatier, Toulouse III, France	Composite Materials	11	D
2	Dr. Liaqat Ali	Professor	PhD	IOWA State University, USA	Manufacturing /Industrial systems	11	D
3	Dr. Khalid Mehmood	Associate Prof.	PhD	University of Manchester, UK	CFD	4	D
4	Dr. Fahad Sarfraz Butt	Associate Prof.	PhD	Technical University, Berlin	Solar Thermal Systems	12	D
5	Dr. Muhammad Farhan Ausaf	Asst. Prof	PhD	China	Manufacturing Automation and Optimization	10	D
6	Dr. Syed Maaz Hasan	Asst. Prof	PhD	NUST Pakistan	Manufacturing Systems	13	D
7	Dr. Tanveer Ahmed	Asst. Prof	PhD	NUST Pakistan	Composite Materials	11	D
8	Dr. Zahid Iqbal Qureshi	Asst. Prof	PhD	City University of Hong Kong	Computational Engineering	7	D
9	Dr. Luqman Ahmad Nizam	Asst. Prof	PhD	UET Taxila	Vibration, Wear Analysis	9	D

10	Dr. Saad Arif	Asst. Prof	PhD	NUST Pakistan	Robotics	11	D
11	Dr. Zarak Khan	Asst. Prof	PhD	NUST Pakistan	Manufacturing Processes	7	D

Annexure – C: Student Course Evaluation

Previous Form

CORE QUESTIONS

Course Content and Organization	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
1. The course objectives were clear	☐	☐	☐	☐	☐
2. The Course workload was manageable	☐	☐	☐	☐	☐
3. The Course was well organized (e.g. timely access to materials, notification of changes, etc.)	☐	☐	☐	☐	☐
4. Comments					

Student Contribution					
5. Approximate level of your own attendance during the whole Course	☐ <20%	☐ 21-40%	☐ 41-60%	☐ 61-80%	☐ >81%
	Strongly Agree	**Agree**	**uncertain**	**Disagree**	**Strongly Disagree**
6. I participated actively in the Course	☐	☐	☐	☐	☐
7. I think I have made progress in this Course	☐	☐	☐	☐	☐
8. Comments					

Learning Environment and Teaching Methods	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
9. I think the Course was well structured to achieve the learning outcomes (there was a good balance of lectures, tutorials, practical etc.)	☐	☐	☐	☐	☐
10. The learning and teaching methods encouraged participation.	☐	☐	☐	☐	☐
11. The overall environment in the class was conducive to learning.	☐	☐	☐	☐	☐
12. Classrooms were satisfactory	☐	☐	☐	☐	☐
13. Comments					

Learning Resources	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
14. Learning materials (Lesson Plans, Course Notes etc.) were relevant and useful.	☐	☐	☐	☐	☐
15. Recommended reading Books etc. were relevant and appropriate	☐	☐	☐	☐	☐
16. The provision of learning resources in the library was adequate and appropriate	☐	☐	☐	☐	☐

17. The provision of learning resources on the Web was adequate and appropriate (if relevant)	☐	☐	☐	☐	☐
18 Comments					

Quality of Delivery	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
19. The Course stimulated my interest and thought on the subject area	☐	☐	☐	☐	☐
20. The pace of the Course was appropriate	☐	☐	☐	☐	☐
21. Ideas and concepts were presented clearly	☐	☐	☐	☐	☐
22.Comments					

Assessment	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
23. The method of assessment were reasonable	☐	☐	☐	☐	☐
24. Feedback on assessment was timely	☐	☐	☐	☐	☐
25. Feedback on assessment was helpful	☐	☐	☐	☐	☐
26. Comments					

Additional Core Questions

Instructor / Teaching Assistant Evaluation	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
27. I understood the lectures	☐	☐	☐	☐	☐
28. The material was well organized and presented	☐	☐	☐	☐	☐
29. The instructor was responsive to student needs and problems	☐	☐	☐	☐	☐
30. Had the instructor been regular throughout the course?	☐	☐	☐	☐	☐

Tutorial	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
30. The material in the tutorials was useful	☐	☐	☐	☐	☐
31. I was happy with the amount of work needed for tutorials	☐	☐	☐	☐	☐
32. The tutor dealt effectively with my problems	☐	☐	☐	☐	☐

Practical	**Strongly Agree**	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
33. The material in the practicals was useful	☐	☐	☐	☐	☐
34. The demonstrators dealt effectively with my problems.	☐	☐	☐	☐	☐

Overall Evaluation

35.The best features of the Course were:

36.The Course could have been improved by:

Equal Opportunities Monitoring (Optional)

37. The University does not tolerate discrimination on any irrelevant distinction (e.g. race, age, gender) and is committed to work with diversity in a wholly positive way. Please indicate below anything in relation to this Course which may run counter to this objective:

Demographic Information: (Optional)

38. Full/part time study: Full Time ☐ Part Time ☐

39.Do you consider yourself to be disabled: Yes ☐ No ☐

40. Domicile:

41.Gender: Male ☐ Female ☐

42. Age Group: less than 22 ☐ 22-29 ☐ over 29 ☐

43. Campus: Distance Learning/ Collaborative ☐

Updated Form (Effective from Spring 2016)

Statements	Score
1. The Class Room facilities and overall environment were conducive to learning.	
2. The recommended Textbook was student-friendly i.e. a student can easily follow it after attending the class lecture.	
3. The library resources, i.e. other books, internet facility, magazines etc. were adequate in supporting the learning.	
4. The concepts were clearly explained.	
5. The course created interest in me to know more about it.	
6. Quizzes, Sessionals and Assignments etc. were helpful in learning this course.	
7. The lab experiments were synchronized with the theory classes.	
8. The lab experiments were helpful in learning the subject.	
9. The lab support was satisfactory.	
10. The course workload was manageable.	
11. I had the knowledge of pre-requisite subjects and mathematics for this course.	Yes/No
Additional Comments:	

The sample student course evaluation for Fall 2020 semester is presented below.

S. No.	Name	Subject	Program	Study in Next Semester	Evaluation
1	Dr. Luqman Ahmed Nizam	Advanced Mechanical Vibrations	MS/PhD	4.44	**4.27**
2	Dr. Abdul Waheed Babar	Solar Thermal Systems	MS/PhD	4.31	**4.25**
3	Dr. Zahid Iqbal Qureshi	Advanced Thermodynamics	MS/PhD	3.67	**4.25**

Annexure – D: Student's Teacher Evaluation

Previous Form

Points	**Instructor's Name** Course Name
1. The instructor is prepared for each class	
2. The instructor demonstrates knowledge of the subject	
3. The instructor provides additional material apart from the textbook	
4. The instructor communicates the subject matter effectively	
5. The instructor shows respect towards students and encourage class participation	
6. The instructor maintains an environment that is conducive to learning	
7. The instructor arrives on time	
8. The instructor leaves on time	
9. The instructor is fair in examination	
10. The instructor returns the grade scripts etc in a reasonable amount of time	
11. The instructor is available during the specified office hours and for class consultation	
12. The subject matter presented in the course has increased your knowledge of the subject	
13. The syllabus clearly states course objectives requirements, procedures and grading	
14. The course integrates theoretical course concepts with real world applications	
15. The assignment and exams covered the materials presented in the course	
16. The course material is modern and updated	
17. Do you want to be taught by this teacher in next semester?	

Updated Form (Effective from Spring 2016)

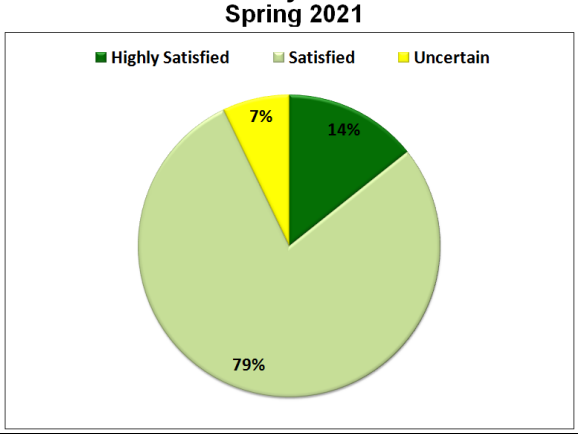
Statements	**Score**
1. The teacher distributed the course plan well in time for the current semester.	
2. The course plan contained objectives, topics, Course Learning Outcomes (CLOs), Grading policy etc.	
3. The teacher was punctual.	

4. The teacher communicated the subject matter clearly and effectively and solved sufficient examples.	
5. The teacher encouraged class participation.	
6. The teacher was fair in marking exam papers.	
7. The teacher returned all marked quizzes, assignments, sessionals etc. in reasonable amount of time.	
8. The teacher was available for consultation during the specified visiting hours.	
9. The teacher encouraged use of Library resources to supplement learning of course topics.	
10. The teacher covered all topics as given in the course plan.	
11. The teacher clearly indicated those questions which were meant for CLOs evaluation.	
12. The teacher encouraged innovative thinking.	
13. You want to be taught by this teacher in the next semester	
Additional Comments:	

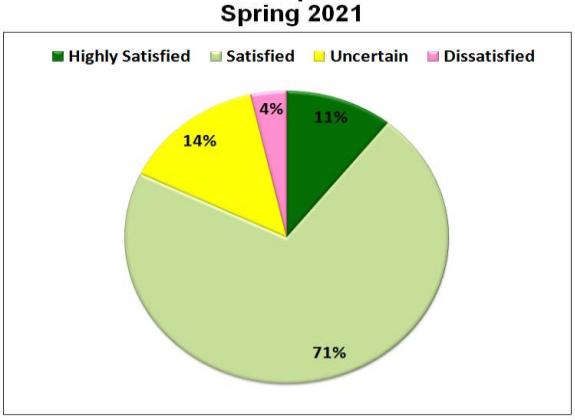
Annexure – E: Faculty Survey

The attached is the faculty survey for Spring 2021 Semester of Mechanical Engineering Department Faculty.

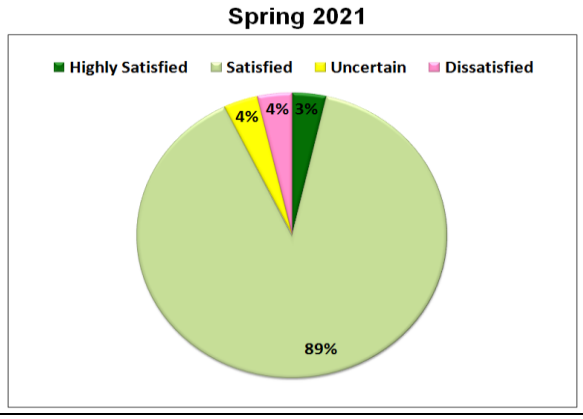
Q1. You are satisfied with your pursuits like teaching, research and the secondary duties.



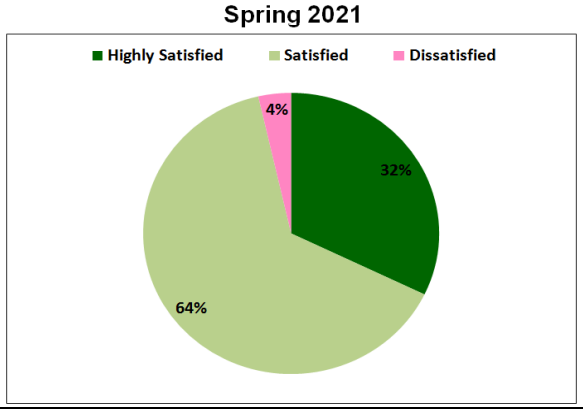
Q2. The overall environment in the department provide intellectual stimulation for improvement



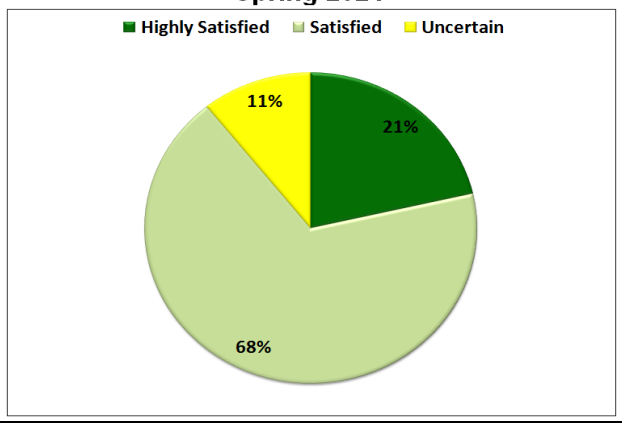
Q3. The overall workload is reasonable



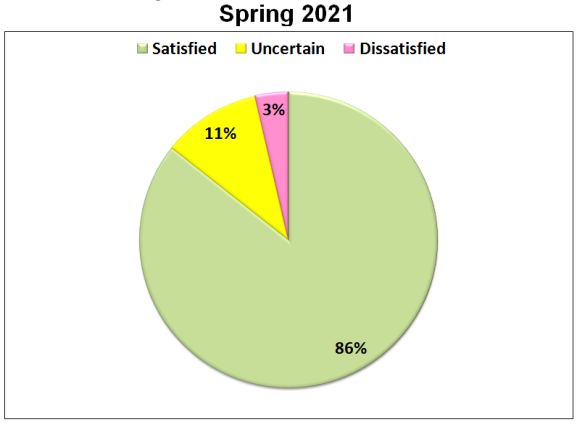
Q4. The cooperation you receive from your department / colleagues



Q5. Whenever needed, the mentoring is available to you

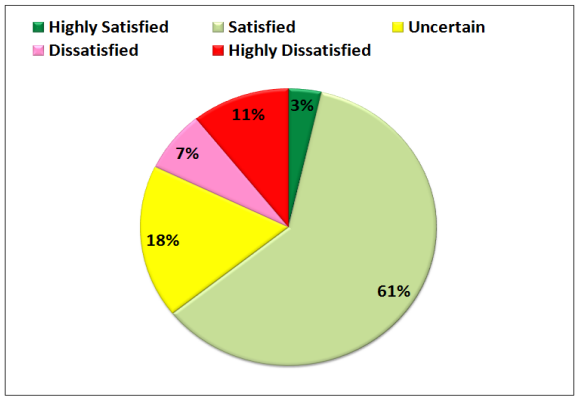


Q6. You are satisfied with the administrative support from the University



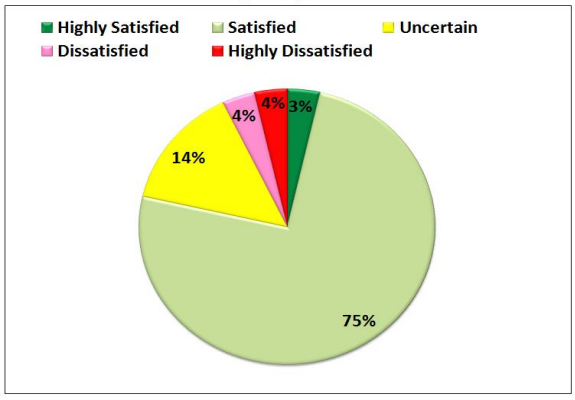
Q7. You are quite clear about the faculty promotion policies and processes

Spring 2021



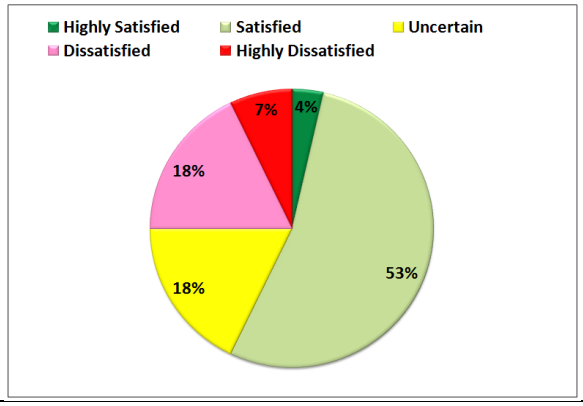
Q8. You are satisfied with the prospects for advancement in your career

Spring 2021



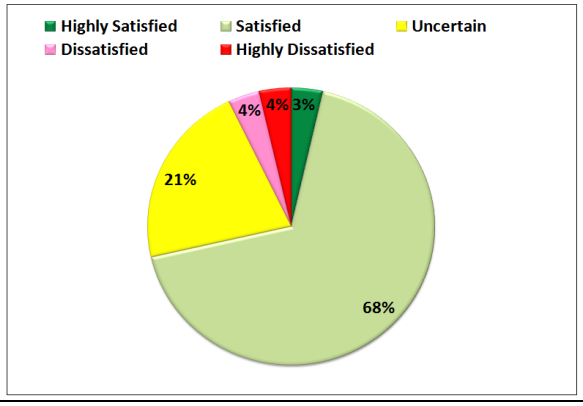
Q9. You are satisfied with the speed of redressal of complaints in the University

Spring 2021



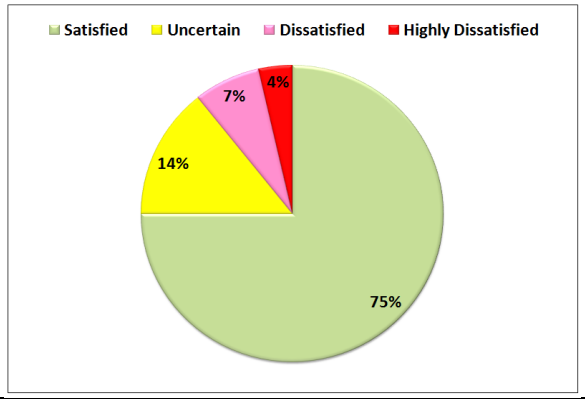
Q10. Your salary package is commensurate with your qualification and experience

Spring 2021



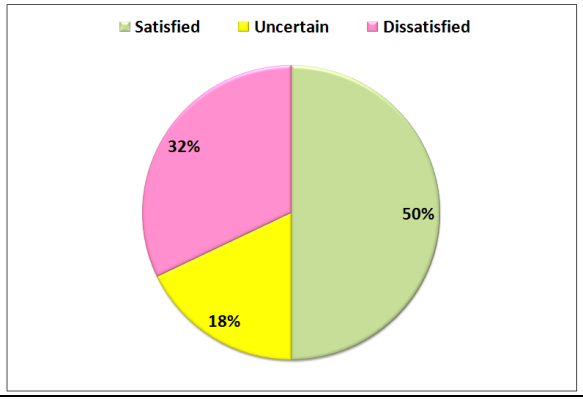
Q11. Your perception about job-security in the present position

Spring 2021



Q12. Your primary and secondary duties permit you to have sufficient quality-time for yourself and your family

Spring 2021



Annexure – F: Faculty Course Review Report

Faculty of Mechanical Engineering is running minimum 18 credit hours of graduate level course work and 30 credit hours of research thesis for the PhD Mechanical Engineering program. All courses curriculum is reviewed periodically by the faculty to assess its effectiveness and contribution in achieving program objectives. Course review also contributes towards making any changes in the syllabi and enhancements required in areas identified as a result of Alumni Survey, Employer Survey and Graduating Students Feedback.

PT members launched HEC Performa 2 (Faculty of Course Review Report) to all the faculty members, to obtain their feedback about courses.

The summary of the overall feedback of all courses identified the following improvement points:

a. Refinement in course outlines.
b. Students' interest should be addressed by giving options in Elective subjects.
c. Provision to interact more with industrial units during study period.

Sample Faculty Course Review Report

GENERAL INFORMATION

Department	Mechanical Engineering
Course Code, Its Name and Semester	ME-813, Advanced Solid Mechanics
Credit Hours	3
Class (batch year) and Number of Students	Spring 2023, 01 student
Course Teacher	Dr. Luqman Ahmad Nizam
Lab Engineer	--