SHRI VENKATESHWARA UNIVERSITY

EVALUATION SCHEME

M.TECH (Structural Engineering)

(Two Years Post Graduation Programme)

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

Evaluation for M.Tech (Structural Engineering)

SEMESTER-I													
Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MSE-101	Advanced Structural Analysis	3	0	0	20	10	30		70		100	3
2	MSE-102	Advanced Solid Mechanics	3	0	0	20	10	30		70		100	3
3	MSE-011	Theory of Thin Plates and Shells	3	0	0	20	10	30		70		100	3
4	MSE-022	Structural Health Monitoring	3	0	0	20	10	30		70		100	3
5	MSE-111	Structural Design Lab	0	0	4				25		25	50	2
6	MSE-112	Advanced Concrete Lab	0	0	4				25		25	50	2
7	MLC-101	Research Methodology and IPR	2	0	0	20	10	30		70		100	2
8	AUD-101	English for Research Paper Writing	2	0	0								0
		Total										600	18

M.TECH SE (Semester I)
MSE-101 - Advanced Structural Analysis (Credits - 3:0:0 = 3)

Teaching Scheme Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to

1. Analyze the skeleton structures using stiffness analysis code.
2. Use direct stiffness method understanding its limitations

Syllabus Contents:

- **Influence Coefficients:** Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.
- **Stiffness Method applied to Large Frames:** Local Coordinates and Global Coordinates.
- **Stiffness Matrix Assembly of Structures:** Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.
- **Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.
- **Boundary Value Problems** (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.
- **Linear Element:** Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

References:

- Matrix Analysis of Framed Structures, Weaver and Gere.
- The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co.
- Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication.
- The Finite Element Method, Desai and Able, CBS Publication.

MSE-102 Advanced Solid Mechanics (Credits - 3:0:0 = 3)

Teaching Scheme Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to

1. Solve simple problems of elasticity and plasticity understanding the basic concepts.
2. Apply numerical methods to solve continuum problems.

Syllabus Contents:

- **Introduction to Elasticity:** Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.
- **Strain and Stress Field:** Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.
- **Equations of Elasticity:** Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.
- **Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.
- **Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.
- **Plastic Deformation:** Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

References:

- Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
- Elasticity, add M.H.,Elsevier,2005.
- Engineering Solid Mechanics, Ragab A.R., BayoumiS.E., CRC Press,1999.
- Computational Elasticity, AmeenM., Narosa,2005.
- Solid Mechanics, KazimiS. M. A., Tata McGraw Hill,1994.
- Advanced Mechanics of Solids, SrinathL.S., Tata McGraw Hill,2000.

MSE-011 Theory of Thin Plates and Shells (Credits - 3:0:0 = 3)

Teaching Scheme Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

1. Use analytical methods for the solution of thin plates and shells.
2. Use analytical methods for the solution of shells.
3. Apply the numerical techniques and tools for the complex problems in thin plates.
4. Apply the numerical techniques and tools for the complex problems in shells.

Syllabus Contents:

- **Introduction:** Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.
- **Static Analysis of Plates**: Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.
- **Circular Plates:** Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.
- **Static Analysis of Shells: Membrane Theory of Shells** - Cylindrical, Conical and Spherical Shells,
- **Shells of Revolution: with Bending** R**esistance** - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels.
- **Thermal Stresses in Plate/ Shell**

References:

- Theory of Plates and Shells, Timoshenko S. and KriegerW., McGraw Hill.
- Stresses in Plates and Shells, UguralAnsel C., McGraw Hill.
- Thin Elastic Shells, KrausH., John Wiley and Sons.
- Theory of Plates, ChandrashekharaK., Universities Press.
- Design and Construction of Concrete Shells, RamaswamyG.S.

MSE-022 Structural Health Monitoring (Credits - 3:0:0 = 3)

Teaching Scheme Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure

Syllabus Contents:

- **Structural Health:** Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

- **Structural Health Monitoring:** Concepts, Various Measures, Structural Safety in Alteration.
- **Structural Audit:** Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.
- **Static Field Testing:** Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.
- **Dynamic Field Testing:** Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.
- **Introduction to Repairs and Rehabilitations of Structures:** Case Studies (Site Visits), piezo– electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

- Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
- Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
- Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
- Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

MSE-111 Structural Design Lab (Credits - 0:0:4= 2)

Teaching Scheme Lab: 2 hrs/week

Course Outcomes: At the end of the course, students will be able to

1. Design and Detail all the Structural Components of Frame Buildings.
2. Design and Detail complete Multi-Storey Frame Buildings.

Syllabus Content:

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

MSE-112 Advanced Concrete Lab (Credits - 0:0:4 = 2)

Teaching Scheme Lab: 2 hrs/week

Course Outcomes: At the end of the course, students will be able to

1. Design high grade concrete and study the parameters affecting its performance.
2. Conduct Non Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
2. Effect of cyclic loading on steel.
3. Non-Destructive testing of existing concrete members.
4. Behavior of Beams under flexure, Shear and Torsion.

Reference Books:

- Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
- Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

AUDIT 1 : ENGLISH FOR RESEARCH PAPER WRITING AUD -101

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

SYLLABUS CONTENTS

- Planning and Preparation, Word Order, Breaking up long sentences, Structuring
- Paragraphsand Sentences, Being Conciseand Removing Redundancy, Avoiding Ambiguity and Vagueness.
- Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising,
- Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.
- Review of the Literature, Methods, Results,Discussion, Conclusions.
- The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.
- Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Research Methodology and IPR MLC 101 3 0 0

Course Outcomes:
At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit 1: INTRODUCTION Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
Unit 2: Effective literature studies approaches, analysis Plagiarism, and Research ethics
Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee
UNIT 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.
Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
- Mayall, "Industrial Design", McGraw Hill, 1992.
- Niebel, "Product Design", McGraw Hill, 1974.
- Asimov, "Introduction to Design", Prentice Hall, 1962.

- Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.

T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand,