M.Phil., and Ph.D., Programmes
Information Brochure

2015
Vignan's Foundation for Science, Technology and Research
Vadlamudi, Guntur Dist.
(website : www.vignanuniversity.org)

Contents

Vignan's foundation for Science Technology and Research (VFSTR)
GUNTUR

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1. INTRODUCTION:

The objectives of the University require it to promote research in the emerging areas of science and technology, humanities and social sciences. The University shall lay special emphasis on the studies of inter-disciplinary nature and those, which address the issues relating to the quality of life of the citizens of India in particular and of the world in general.

"Research" means systematic study or investigation in order to discover new knowledge in the form of facts/patterns or new interpretation of ideas or inventions of new devices or to explore a unified theory to explain diverse facts.

2. CATEGORIES OF CANDIDATURE:

The University shall admit Ph.D. students under the following categories

a) **Full Time:** Students under this category shall work full time for the Ph.D. courses/research. They may apply for fellowship/assistantship available from different funding agencies.

b) **Part Time**: Candidate working in VFSTR or any other organization can register as part-time candidate. He/She should have a supervisor from the University and should meet him regularly. He/she may also have another supervisor form the parent organazation.
He/She may carry out the work at the university or at his/her Parent organization

c) **External**: Candidate employed in an organization/institution / industry that has facilities to carry out research in the candidate's chosen field, can register as an external candidate He/She has to attend to the university for one semester to complete the course work. He/she can take permission to work externally in his/her parent organization, after the course work is completed. He/She should have supervisor in that organization, authorized by the University. He/She may also have another supervisor form the University.

3. ELIGIBILITY AND ADMISSION OF CANDIDATES:

Admission shall be open to Full-time, Part-time or External candidates who fulfill the following requirements and get through the written test or interview or both.

<u>**Ph. D**</u>.
For engineering disciplines, candidates must have obtained Post Graduate Degree or equivalent in the relevant engineering field. For Management studies, the candidate must

have Post Graduate Degree in the relevant field or any Masters degree with relevant experience. Candidates must have obtained minimum marks of 60% aggregate in the qualifying degree. However URC may give 5% relaxation if the candidate is found otherwise admissible by the selection committee.

Candidates who have qualified in the UGC-CSIR/NET examination, or awarded with Research Fellowship by UGC/CSIR/Government Organization are exempted from written test for Ph.D. admission but however they should appear for the interview.

M.S.

Candidate must have a B.E./ B.Tech., or its equivalent in the relevant engineering discipline with a minimum of 60 percent marks on aggregate. M.S. is essentially a research programme normally for candidates in service.

M.Phil.

Candidates must have a Post Graduate Degree in concerned discipline with a minimum of 60 percent marks in aggregate. However URC may give 5% relaxation if the candidate is found otherwise admissible by the selection committee.

4. GENERAL INFORMATION:

a) In case of external candidates, the parent institution, where the candidate works, must satisfy the URC through a formal application, that the institution has sufficient infrastructure for research. This condition is waived for established research organization and major industries.

b) Candidates admitted under Research Fellowship Programme of VFSTR or National Research Fellowships, shall be deemed as Full-Time Research Scholars and they are required to work Full-Time for their Ph.D. Programme in VFSTR for the stipulated duration on the research topic and they shall not undertake any employment during that period. However, they can work for their Ph. D. in any national Laboratory or a reputed Institute with the permission of the Vice-Chancellor, VFSTR. The fellowship to full time regular candidates (not sponsored) shall be determined by the URC from time to time.

c) A candidate seeking admission as part-time scholar will have to declare and register as such and produce, at the time of registration, a letter from the employer permitting the candidate to pursue the course.

d) Candidates selected under Research Fellowship Programme must execute a bond stating that they would refund the Fellowship amount received till that time, in case they discontinue the research work on their own.

e) The University reserves the right to terminate the Fellowship of any candidate if the progress of research work is not satisfactory.

f) University may permit conversion of Full Time Fellowship programme to Part-Time Research Programme without Fellowship on the request of the candidate.

g) The University may permit modification in the Area of research provided the candidate has applied for it within one year from the date of admission. The area of research is the broad area of research whereas the title of research is the caption of the thesis.

5. FEE PARTICULARS:

a. On selection for admission, candidates shall be required to pay the prescribed fee as determined by URC from time to time. The fee and deposits have to be paid on stipulated dates regularly every year, till the successful completion of the programme and submission of thesis or cancellation of the admission as the case may be. If the fee is not paid by the stipulated due date, a late fee will be levied. Non-payment of the prescribed fee beyond the extended due date will lead to the cancellation of admission with prior notice to the candidate.

b. All the fee payments shall be made in the form of bank draft drawn in favour of The University.

c. The tuition fee for M.Phil/Ph.D., is Rs. **25,000/-** per annum.

In addition Admission fee, Library fee have to be paid.

1. SCHOOL OF BIOTECHNOLOGY
(Code: BT)

The School of Biotechnology drawing upon its strength of high qualified, well trained faculty, state of art infrastructure, innovative teaching methodology, regular counseling sections acts as a powerful catalyst to affect the Metamorphosis of an average student into a confident, highly employable engineer who is abreast of the latest and fast changing technological trends in the market. School of Biotechnology offers the following UG and PG and programmes e.g., B.Tech in Biotechnology, M.Tech in Biotechnology and Bioprocess Engineering and Ph.D.

Eligibility for Ph.D:

A postgraduate in Biological / Chemical Engineering or allied areas with a minimum of 60% marks.

Research Activities:

The Department is potentiated with four doctorates, who are actively engaged in research. The following faculty members are already recognized as research guides by other reputed Universities and research scholars are actively engaged in various thrust areas of Biotechnology and allied areas. About sixty research papers in international and national journals are to the credit of these members. Faculty members are supported by the management personals, to motivate for their involvement in various thrust areas of research & development programmes like Ph.D/ M.Phil. The thrust areas in which research is being pursued in the School of Biotechnology may broadly classified into:

 ➢ Production of Chemicals from Biowaste
 ➢ Production and Synthesis of Plant & Animal based active components
 ➢ Biofertilisers and Eco-friendly technologies
 ➢ Enzymatic liquifaction of pulpy fruit juices
 ➢ Utilization of whey from dairy industry for making value added chemicals
 ➢ Microbial activity of selected endemic and endangered medicinal plant species
 ➢ Spectrophotometric studies of biomolecules
 ➢ Dehydration - mechanism & modeling, Microwave heating/drying
 ➢ Processing of fruits & vegetables
 ➢ Design of small scale gadgets for Food Processing
 ➢ Phytoremediation
 ➢ Plant tissue culture studies

Library:

The central library prescribes seven reputed research journals (Indian Journalof Agri. Sciences, Indian Jour. of Animal Sciences, Jour. of Bioscience, Jour. of Genetics, Indian Jour. of Traditional Knowledge, Indian Jour. of Biotechnology, Advances in Biotechnology and Pharmacy) and five E-Journals are available. A separate library is available in the school for quick reference purpose of the research scholars. The School library consists advanced books for research purpose, latest issues of the journals, publications of faculty members and research dissertations.

2. SCHOOL OF CHEMICAL ENGINEERING

(Code: CH)

Chemical Engineering provides the basic scientific and engineering knowledge for the design, construction and operation of equipment and plants that process materials by chemical and physical operations into desired products. The curriculum is aimed at provision of a broad background in the underlying sciences of Chemistry, Physics and Mathematics, and detailed knowledge of Chemical Engineering principles. This enables graduates to proceed to further academic degrees by study and research at this University or elsewhere, or to carry on research, development, design or production operations in any process industry. Students can complete the general program or one of two option programs: Chemical Engineering and Environmental Engineering. The School offers M.Tech and Ph.D in Chemical Engineering. The School of Chemical Engineering considers practical training and close contact with Industry an important aspect of the engineering curriculum. The Industrial Practice Program includes both the two week Chemical Engineering Practice School and the work term or co-op components carried out in industry.

Topics of research interest are:

- **Mass Transfer Operations**: Principles and techniques of quantum mechanics. Concepts and techniques of statistical thermodynamics. Using statistical thermodynamics to derive thermodynamic quantities and relations. Chemical reaction kinetics. Kinetics of complex reactions. Molecular reaction dynamics. Collision theory, Activated complex theory, Laboratory experiments.

- **Energy Systems**: Conventional energy sources - Characterization of feed stocks - The total energy concept of petroleum industry, Non-conventional energy sources - Solar energy, Wind energy, Tidal and Wave energy, Nuclear energy, Ocean, Thermal and Hydrogen energy - Biomass as a source of energy.

- **Environmental Biotechnology**: Application of biotechnology to the management of environmental problems. Biotechnology for enhanced plant and animal production through biological insecticides, herbicides resistance, mineral cycling, conservation of genetic resources and biological nitrogen fixation. Use of biotechnological processes for pollution control, bioremediation of toxicants and treatment of domestic and industrial wastes. Ethical issues related with the release of genetically modified organism.

- **Separation Technology**: Characteristics of separation processes, Inherent separation factors for equilibrium processes and rate – governed processes. Equilibrium calculations, Analysis of simple equilibrium separation processes. Additional factors influencing product purities. Binary multistage separations: Binary multistage separations, Multi component multistage

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separations, Computational approaches. Energy requirements of separation processes. Selection of separation processes – Factors influencing the choice of a separation process.

- **Environmental Pollution Control**: Air: Sources of pollution, Methods of monitoring & control of air pollution. Water: Types, sources of H_2O pollution, physico-chemical & bacteriological sampling & analysis of H_2O quality, water borne diseases. Waste water treatment & recycling. Noise: Sources of noise pollution, Measurement of noise & indices. Noise exposure levels & standards. Noise control & abatement measures. Impact of noise on human health. Maxine: Sources of marine pollution & control. Radioactive & Thermal Pollution

- **Waste Water Treatment**: Characteristic wastewater, Classification of Wastewater Treatment Techniques – Unit operations and process; Biological units: Variation in Quantity and Quality of Industrial wastewater; Guidelines for discharge of Industrial Effluent on land into Muncipal Sewers and Natural water; Joint treatment, volume reduction, strength reduction, equalization neutralization and proportioning; Estimation of process kinetic parameters.

- **Membrane Separation**: Material, Membrane Preparation and Characterization, Pressure driven processes, Polarization phenomenon and fouling, Design of Membrane System, Aspects and advances in Membrane Separation Process

LABORATORY:

At Vignan's School of Chemical Engineering, graduate & Postgraduate research often results in the development of innovative and patentable ideas, leading to new technologies and, sometimes, new companies. Faculty members in the School have strong interactions with industry, including consulting, sponsored research, and/or advisory board activities. Opportunities continue to arise to use your technical and entrepreneurial abilities to create new solutions to societal problems. Research is supported by state-of-the-art research and computing laboratories. The students participate in and university-wide multidisciplinary research thrust areas. The School of Chemical Engineering also has a strong research thrust in the area of separations, particularly membrane separations. Additional research thrust areas include environmental sustainability, computational fluid dynamics, and biotechnology. Exceptional facilities are available for the synthesis and characterization of membrane materials, molecular and cellular biological samples, novel catalysts, polymeric materials, and surface coatings.

LIBRARY:

The Central and School of Chemical Engineering Library began its existence in 1997. Since then, it has grown in size and content along with the Vignan University to take the present shape. All these years, it has been the life-line for the academic activity of the institute. At present, it stands as a modern library with a lot of automation and as the largest of the surrounding in terms of the number of books and journals. Library is kept open on all the days, excepting the Institute Holidays.

3. SCHOOL OF CIVIL ENGINEERING

(Code: CE)

The school offers academic programmes in undergraduate, postgraduate and research leading to B.Tech in Civil Engineering, M.Tech in RS&GIS, Water resources Engineering and Ph.D in the area of Civil Engineering. These programmes are flexible and allow the students to choose courses from a number of electives offered by the department that cover a wide range of topics in Civil Engineering

RESEARCH ACTIVITIES:

The department has earned a good reputation as a center for academics, research and industrial consulting activities. Laboratories with state-of-art equipment, highly qualified faculty and dedicated supporting staff provide an ideal environment for academic and research pursuits. The department is well known for its R&D activities as is evident from the completed and ongoing research projects funded by external agencies like DST, AICTE, and APOST etc. The areas in which research is being pursued in the school may broadly be classified into following areas.

Facilities available:

- ✓ Geographical Information Systems Lab
- ✓ Visual Image Interpretation Lab
- ✓ Digital Image Processing lab
- ✓ Surveying and mapping Lab
- ✓ Water Resources Modeling Lab
- ✓ Hydraulic Lab
- ✓ Hydrometereological Station
- ✓ Geophysical and Surveying Lab
- ✓ Environmental Data Computations Lab.
- ✓ Environmental Geo informatics Lab.

Ph.D Topics:

- **Water resources systems planning and management**

- **Environmental and Water Resources Engineering**

- **Remote sensing and GIS for environmental management**

- **Solid waste and hazardous waste management**

- **Global positioning system (GPS) & Remote sensing**

- **Channel and river hydraulics**

- **Ground water management & modeling**

- **Environmental Management**

- **Solid waste Management**

- **Environmental Impact Analysis**

- **Clean Technologies**

- **Life Cycle Analysis**

4. SCHOOL OF COMPUTING

(Code: CS)

(Areas: Computer Science &Engineering and Information Technology)

School of computing has well-qualified and experienced faculty who are specialists in the areas of Wireless Networks, Parallel Computing, Data Mining, Image Processing, Artificial Neural Networks, Information Security and Programming Languages. There are around 50 dedicated faculty members with good amount of experience in these different areas. The faculty members are actively involved in research activities in the field of their specialization. They have published many papers in journals and Conferences of National and International repute. The School attributes its success to the creative and innovative outlook of its students also. The School encourages students to participate in numerous symposiums and to present papers in them.

Due focus is given to research activities by encouraging faculty to take up projects to suit the local and the industry needs. The equipment available in the laboratories is used for research work by faculty and students. Extensive Internet bandwidth such as 16 Mbps and intranet connectivity exposes the faculty and students to the advanced information available outside and inside the institution. The institution subscribes to 129 on-line journals from professional institutions like IEEE, which are accessed through digital library. These journals can also be accessed in the school.

The DELNET facility enables the access to any journal or a book from libraries of DELNET-registered institutions in the country, within 15 days, as a part of inter library loan facility.

Areas of Research Interest are:

Mobile Computing: MANETS, sensor networks, Interference Issues.

Data Mining: web mining, spatial data Mining, Temporal Data Mining.

Networks: Protocols, Network performance and analysis, IPv6, Internet Technologies, Low-cost Networking,

Computer Architecture and Operating Systems:
Computer Architecture, General Purpose Operating Systems, An Operating systems for Embedded controllers, Distributed Computer Architectures, Client-Server computation, Parallel and Distributed Computation, Cluster and Grid Computing.

Digital Image processing: Biometrics, Machine Intelligence.

Soft Computing: Artificial neural networks, Fuzzy Logic,Genetic Algorithms.

5. SCHOOL OF ELECTRONICS ENGINEERING

(Code: EC)

The **Department of Electronics and Communication Engineering** was established in the year 1997 to start a B.Tech programme affiliated to the JNT University, Hyderabad. The first batch of students graduated from the department in the year 2001. A postgraduate programme, leading to M.Tech in 'Embedded Systems' was introduced in the year 2006. Consequent to the establishment of JNT University in Kakinada, the affiliations of both programmes were shifted to the new University from 2008 onwards. The undergraduate programme Electronics and Communication was accredited by NBA in the year 2006. In the year 2008, the college was accredited by NAAC and awarded an 'A' grade. The institution has been conferred with Deemed-to-be University status by UGC from January 2009. Thus, from a modest beginning, the department has come a long way. Today, it is one among the leading educational institutions of the country in Electronics and Communication Engineering and is now named as School of Electronics. The school of Electronics offers the following UG and PG programmes.

- B.Tech in Electronics and Communication Engineering
- M.Tech in Embedded systems
- M.Tech in VLSI Design

The faculty in the school are actively involved in research in various fields of Electronics. The areas of research in which the school offers doctoral programmes are broadly classified as follows.

Signal Processing: Analog and digital signal processing; Signal representation and transforms; Statistical signal processing; Filter design & digital filters; Multi-rate and wavelet signal processing; Coding techniques; Adaptive signal processing; Spectral analysis; Time-frequency signal analysis; Speech & language processing; Signal modeling, identification & prediction; System identification; Biomedical signal analysis; Design and implementation of DSP systems; Software development; Intelligent signal processing; Acoustics; Multi-dimensional signal processing; Sensor array and multi-channel systems; Signal processing applications; Other topics in signal processing

Image Processing: Still image coding, stereoscopic and 3-D coding, distributed source coding, image transmission, Image filtering, restoration and enhancement, image quality assessment image segmentation, Image scanning, display, and printing, Scanning and sampling, quantization and half toning, color reproduction, image representation and rendering and display and printing systems. Image databases, image indexing and retrieval, retrieval and editing, multimodality image indexing and retrieval, authentication and watermarking.

Video Processing: Video coding, Error concealment, Sub-picture video coding for unequal error protection, Coding of faded scene transitions, Picture buffering for prediction references and display, Sub-sequences for video coding, Isolated regions in video coding, distributed source coding, video segmentation and tracking, motion detection and estimation, video databases, video quality assessment, video indexing and retrieval, video authentication and watermarking.

Medical Image Processing: Reconstruction and restoration, imaging systems, imaging modalities, tomographic image reconstruction, image registration, image fusion, processes for image archiving and communication.

Networks on Chip: Network architecture (topology, routing, arbitration,...) ,Power and energy issues in NoC ,NoC case studies, application specific NoC design ,Timing, synchronous /asynchronous communication ,NoC reliability issues ,O/S support for NoC , Metrics and benchmarks for NoCs , NoC Network interface issues , Modeling, simulation, and synthesis of NoCs , Network-on-chip design methodologies , NoC Quality of Service ,NoC support for memory access , NoCs for FPGAs and structured ASICs ,Programming models ,Mapping of applications onto NoCs , Novel interconnect links / switches /routers , Signaling and circuit design for NoC links , Physical design of interconnect and NoC , NoC design tools , Debug & Test of NoC , Floorplan aware NoC architecture optimisation .

System on Chip: Analog and mixed signal and RF circuits and systems, Low power circuits systems and design methodologies, wire line and wireless circuits and systems, Design for manufacturability and variation aware methodologies, signal integrity, design for testablility and design verification, system level design methodology, EDA and design tools for SoC, Embedded systems, multi/many core systems and embedded memory technologies, reconfigurable and programmable circuits and systems, system on programmable devices (FPGAs).

Facilities:

The school of electronics has well equipped laboratories and department library apart from the central library. A dedicated 16 MBPS Internet connection is installed to meet the need of faculty and students to pursue their research. All the systems on the campus are wired to file servers. The faculty and students can access IEEE – Online journals and DELNET, a network of libraries to share books and research material.

The laboratories available in the department :
• Electronic Devices and Circuits Lab
• Network Theory and Electrical Engineering Lab
• IC Applications Laboratory
• Communications Laboratory
• Microwave and Optical Communication Lab
• Microprocessor and Interfacing Laboratory
• Embedded systems Laboratory
• VLSI laboratory
• Digital Signal Processing Laboratory
Software Available:
- Pspice Software ORCAD CAPTURE
- VHDL Software Mentor Graphics
- XILINX VLSI Design Software
- MATLAB 7.1
- Code Composer Studio
- Keil-PK51-C51 Professional developers kit
- Keil-MDK-ARM-Real view micro controller development kit, Lab view full development system

6. SCHOOL OF ELECTRICAL ENGINEERING

(Code: EE)

Department of Electrical and Electronics Engineering has been one of the key schools in Vignan University since its inception. The department has expanded steadily over a decade and is now recognized as one of the leading academic and research centers in the university. The school is engaged in a wide spectrum of established and emerging electrical engineering disciplines. The department has three research groups**: Power electronics, Control Systems and Power systems**. Also, due to the ubiquitous nature of this branch, the school has substantial interaction with other engineering disciplines. The school has strong links with academia and industry across the country. State of the art computational and experimental facilities enable the department to undertake basic and applied research. The academic programs of the department are rated very high.. The graduating students are well placed in leading academic institutes, research organizations and Industries.

Academic Programs:
The school offers a comprehensive B. Tech program in Electrical and Electronics Engineering and an intensive M.Tech program in Power Electronics and Drives. The School is planning to start a five year Dual Degree program (B. Tech +M. Tech degrees) in Electrical and Electronics Engineering with Management studies. The Ph.D. program offers exciting opportunities for research in emerging areas.

Facilities:
Additionally, the school of Electrical and Electronics has its own library, study rooms and a PC laboratory for general computer usage. The department is wi-fi enabled. The department is well equipped with numerous laboratories covering
All disciplines of Electrical Engineering, the main among which are:
- Power Electronics Lab
- Electrical Machines Lab
- Control Systems Lab
- Electrical Measurements Lab
- Simulation Lab
- Networks Lab

Research activities:
Research activities are currently focused in the following areas. The fields covered in recent years include:

❖ Power flow control in deregulated power systems and pricing of electricity.

❖ Neuro-Fuzzy system applications in Electric Motor Control

❖ Control and Estimation of 3-phase Induction Motor Drives

❖ Application of Hybrid Power sources for Electric vehicles

Publications:

There are several publications from the faculty members of the School of Electrical & Electronics Engineering . They published approximately 50 journal papers and conference papers.

Research areas:

Neuro-Fuzzy system applications in Electric Motor Control

Congestion management and Loss allocation in deregulated Power systems

Vector control of Induction machines

Hybrid Electric Vehicles

7. SCHOOL OF MECHANICAL ENGINEEING

(Code: ME)

(Areas: Mechanical Engineering & Industrial Engineering)

The school offers academic programmes in undergraduate, postgraduate and research leading to B.Tech in Mechanical Engineering, Mechatronics Engineering, and M.Tech in Machine Design and Ph.D in the area of Mechanical Engineering. These programmes are flexible and allow the students to choose courses from a number of electives offered by the department that cover a wide range of topics in Mechanical Engineering.

RESEARCH ACTIVITIES:

The department has earned a good reputation as a center for academics, research and industrial consulting activities. Laboratories with state-of-art equipment, highly qualified faculty and dedicated supporting staff provide an ideal environment for academic and research pursuits. The department is well known for its R&D activities as is evident from the completed and ongoing research projects funded by external agencies like DST, AICTE, and APOST etc. The areas in which research is being pursued in the school may broadly be classified into following areas.

Nanocomposites: Preparation and characterization of polymer nanocomposites using nanoparticles, modification of nanoparticles, effect of reinforcement on bearing strength, improving strength in Z-pins insertion.

Nanofluids: Preparation of metallic, nonmetallic and biodegradable nanofluids, thermal conductivity measurement of nanofluids using Transient Hot Wire method and Pelletier methods, convective heat characteristics in Heat exchangers.

Fluidized Bed: conventional fluidization, Gasification of solid fuels, renewable fluidization, fluidization of solid waste, rice husk fluidization, Nanoparticle fluidization.

Fluid Mechanics and Aerodynamics including CFD: supersonic, transonic and subsonic aerodynamics; boundary-layer flows; high-speed jets; drag reduction, wakes; transition and turbulent flows; hypersonic flows; wind tunnels, flow through porous media.

Optimization Studies: Optimization studies for improvement of Product mix in Industries, Thermodynamic Optimization of Energy systems, Optimization Studies in heat Transfer.
Heat Transfer: Convective heat Transfer in Porous Media, Heat Transfer analysis in flow fields around extended objects (Turbo machinery blades), Heat Transfer analysis in electronic Equipment.

Industrial Engineering: Production Scheduling studies, Supply chain Engineering, Total quality System, Productivity Studies

Facilities Available:

- Material testing machine (universal testing machine)
- Torsion testing machine for small rods
- Ultrasonic bath
- High Energy Ball Mill
- THW test setup.
- Peltier element test setup
- CNC Lathe machine
- Agilent Data logger
- Thermostatic bath
- Fluidized bed combustion Equipment

8. SCHOOL OF MANAGEMENT STUDIES

(Code: MS)

School of Management Studies, Vignan University imparts top quality Management Education through a range of programs, suited to the specific needs of a researcher. These entire courses are planned to counter the challenges and constraints of the real world. Thus, most of the researchers pursue these programs with the aim of making it big in various manufacturing, retail and service sectors.

The school of Management Studies, Vignan University, Faculty and students are working on a wide spectrum of issues in Management, Agricultural Rural Economy such as Diversification of Agriculture, Rural Transport, Distribution of Gains, Watershed, Agricultural Subsides, Female Employment, Women empowerment, Sustainability, Population Land Use, Hi-Tech Agriculture, Marketing, and Rural Credit. Etc.

The school of Management Studies, Vignan University, offers P.hd and M.Phil in the following areas i.e

1. Accounting and financial Management.
2. Economics ,Entrepreneurship
3. Human Resource Management
4. International Business
5. Marketing Management
6. Operations Management
7. Technology Management