

Monitoring and Management of Stress: A study of Engineering Students using Digital Electronics Meter

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DECLARATION

I hereby declare that this thesis "Monitoring and Management of Stress: A study of Engineering Students using Digital Electronics Meter" is an original work done by me for the award of Degree of Philosophy in Management. I also declare that this thesis or any other part of it has not been submitted by me for the award of any degree, diploma, title or recognition before.

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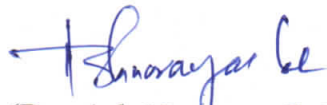
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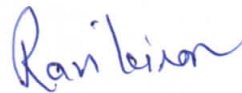
CERTIFICATE

Certified that the thesis entitled, "Monitoring and Management of Stress: A study of Engineering Students using Digital Electronics Meter" which is being submitted by Anurag Joshi in fulfillment of the requirements for the award of Degree of Doctor of Philosophy in Management, Thapar University, Patiala is a record of candidate's own work, carried out by her under our own supervision and guidance. The matter embodied in this thesis has not been submitted in part or full to any other University or Institute for the award of any degree.



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ABSTRACT

Stress embodies the experience of emotions or bodily strain. Stress may be experienced in two ways i.e emotional or physical. Emotional stress tends to be found there where the situations perceived by people are tough and intriguing. So far as physical stress concerned, it is the reaction of the body due to various triggers, the pain experienced after surgery is an example of physical stress. There is a participation of ‘control’ and ‘tension reduction’ in stress management which takes place in stressful situations by making emotional and physical changes. In order to know how much changes takes place, it is important to know the level of stress and the dire need for attaining the change.

Our present educational system has become quite mechanical and stressful, and fails to nurture an all round development of the personalities of the students. Therefore, an urgent need of an hour is to remodel the education system, so that it may fulfill the dreams of our Father of Nation Mahatma Gandhi who defines education - a system of an all-round drawing out best in child and man, in body, mind and spirit. Any educational system, which does not aim to develop the students in a holistic manner, will fail to produce true human being since they are going to contribute significantly in the society in various ways. The present study is a scientific effort in stress management of engineering students.

The students (males as well as females) were opted from the four common streams of both Universities viz. i) Civil , ii) Computer, iii) Electronics & Communication, and iv) Mechanical Engineering and two engineering universities. The Stress level was assessed with the help of a self-structured questionnaire.

ANOVA was performed to study whether there is a significant difference in the factors influencing stress on the basis of gender, age, engineering streams and nature of University. The three types of stress considered for the study include: academic stress, personal stress, financial stress. Further, difference of perception was also accorded for Stress Relieving Strategies. For analyzing inter-group differences on the basis of age, engineering streams post hoc Tukey was performed.

The study indicates that there is a significant difference in the factors influencing academic stress, personal stress and stress Relieving Strategies on the basis of different

streams of engineering. There is also a significant difference in case of the financial stress factors with respect to the gender.

In this experimentation, the researchers investigated the effects of various drills on physiological parameter GSR monitored through Digital Electronic Meter. After taking the permission from ethical committee for conducting this experimental study, the respondents were also requested to sign a consent form.

There were two groups, Control and Experimental group. The Experimental group had 200 students, who were exposed to various stress management strategies as reported in section.

Furthermore, it was found that the mean GSR value decreased under the stimuli of i) Yogic Breathing; ii) Musical Religious Hymns; iii) Flute Music; and iv) Saxophone Music. Results also indicated that the effective Stimuli for managing stress of Engineering Students was listening to flute, followed by yogic breathing.

Like any research study, the present study also has some limitations. One limitation is that of the time of experimentation. The participants' subjective feedback at $t=300$ seconds would have added more inputs and deepened the analysis. Further, this study can be extended and repeated experimentation may be performed. This would help in finding out whether participants' GSR levels are usually reduced by the four stimuli included in the study. This is an initial attempt and results are encouraging. Repeated experiments will also help in finding out how long do the lowered GSR levels remain. In addition to GSR (skin conductivity), the other physiological parameters like Breathing Rate, Pulse Rate and Blood Pressure could also be included for analysis. It is time to think intensely about managing and controlling, stress as it is leading to depression and tackling it, is an urgent concern.

Academic Stress can severally hinder academic performance as well as adjustment in life. The suggested research will help reduce stress, improve efficiency and productivity of the engineering students. This endeavor may help in plummeting bad habits that emerge from stress like drug addiction, smoking and drinking. Their physical and mental health will improve. This study can be extended to students of other colleges and public enterprises. The study will also be extremely useful for students of Medical and para-medical sciences. The suggested techniques can be adopted for managing stress in educational institutions.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
df	Degrees of freedom
F	F ratio
Sig	Significance
FA	Factor Analysis
C	Cumulative Variance
AVE	Average variance extracted
CR	Composite Reliability
AS	Academic Stress
PS	Personal Stress
FS	Financial Stress
SRS	Stress Relieving Strategies
GSR	Galvanic Skin Response
www	World Wide Web
NSP	Nadi Shodhan Pranayama
ANS	Autonomic Nervous System
NCR	National Capital region

CHAPTER – 1

INTRODUCTION

This Chapter Introduces The Research Problem. Section 1.1 envelops the Introduction of the topic. Section 1.2 focuses on Stress. Section 1.3 covers Causes of Stress. Section 1.4 Strategies for Managing Stress. Section 1.5 explains Measurement of Stress. Section 1.6 presents the Rationale for the Study. Section 1.7 contains the Research Objectives. Section 1.8 presents the Implications of the Study. Section 1.9 wraps the Organization of the Thesis. Section 1.10 gives concluding remarks.

1.1 Introduction

Stress embodies the experience of emotions or bodily strain. Stress may be experienced in two ways i.e. emotional or physical. Emotional stress tends to be found there where the situations perceived by people are tough and intriguing. So far, physical stress is concerned, is the reaction of the body due to various triggers. The pain experienced after surgery is an example of physical stress. Physical stress frequently contributes to emotional stress, which leads to physical stress (e.g., cramps in stomach). There is a participation of ‘control’ and ‘tension reduction’ in stress management which takes place in stressful situations by making emotional and physical changes. Stress affected students may resort to take drugs and alcohol making them socially isolated and self harm (Gokul *et al.* 2016; Arria *et al.* 2009). In order to know how much change takes place, it is important to know the level of stress and the dire need for attaining change. These thoughts were reverberated by Bernstein *et al.*, (2008) and Auerbach and Grambling (1998).

College life is a stressful time for many students as they go through the process of adapting to new educational and social environments. Our present educational system has become sheer mechanical and it fails to nurture the all-round development of the personalities of the students. Therefore, an urgent need of the hour is to rejuvenate the educational system, so that it may fulfill the dreams of our Father of our Nation Mahatma Gandhi who advocated education as - an all round development system, drawing out

best in child and man, body, mind and soul. Any educational system, which does not aim at to develop the child in a holistic manner, will fail to produce a true human being. The present study is an effort in above mentioned direction by preparing and applying the instrumental monitoring to create a holistic education system, which may help the educators in developing body mind and spirit of their students, so that our education system enables all the individuals to create a balance between material prosperity and spiritual growth. In the present project, the researchers present some accuracy tests on a low-cost and open-source e-HRM that may be highly useful in current environments of educational institutions. Also, it is proposed to monitor, control and tailor the traits through the application of various techniques.

The aim of technical education is to provide an individual with productive existence in the society. A set of educational policies and procedures, right attitude and right actions will assist in improving the quality of education. Moreover, the product of this process depends on its raw material and the quality of technical education and is dependent upon the students' aptitude and ability. The students coming to the technical institutions should be enough smart mentally as well as physically to perform well and, as an Institution imparts effective learning through the teachers.

Engineering Institutions as well as the intake in Engineering Education is showing a remarkable increase during last decade. The growth rate of number of institutes was 2.88 % per annum. This rapid increase in number of Engineering Institutes and student intake on one hand is depicting the massive demand for engineering courses, but also hidden are the problems associated with massive expansion. One such issue is the employability of graduate engineers. Will we be able to provide suitable jobs and respectable future to these colossal turnouts? The more pertinent question is how to raise the performance level of a student to a certain standard. It emphasizes to provide quality education. This needs good teaching learning environment, suitable teacher-taught ratio, state of art laboratories and latest knowledge management technologies for sharing & disseminating knowledge. One issue that demands an immediate attention is the increasing amount of stress in engineering graduates. This might be related to academics, examination, peer, teachers/parents' pressure and high financial aspirations.

1.2 Stress

The word “stress” was first introduced in the fields by distinguished endocrinologist, Hans Selye, and was popularly used in the seventeenth century and derived from Latin word to mean “Hardship”, “Strait”, “Adversity” or “Affliction.” Selye (1950) suggested that stress is simply the rate of wear and tear in the body. His concept of stress at that time was a physiological one and throughout his life the psychological component of the phenomenon of stress was not so much ignored by him, as placed in a secondary, and to some degree, less important place in the total picture of human stress.

As per to the transactional model, when the person comprehends an external demand as broadening his or her capability to deal with, stress is believed to take place. Thus, whether stress is experienced by an individual is determined by personal valuation of the demand nature, resources available and human skills, and presumed results. Recognition and dealing with individual differences are the goals of this approach. (Cox, 2003). Academic stress has been studied extensively as an important factor in college student adjustment (Gall, Evans, and Bellerose, 2000; Mallinckrodt, 1988). In general, college-related stress has been found to be inversely related to academic performance among traditional undergraduates (Felsten and Wilcox, 1992; Pritchard and Wilson, 2003; Russell and Petrie, 1992)

Thus, it is important to examine the stress level of engineering students, the reasons for its increase and focus on methods to manage stress. Mechanisms that explains why students perform badly under stress include "hyper vigilance" (excessive alertness to a stressful situation resulting in panic - for example, over studying for an exam) and "premature closure" (quickly choosing a solution to end a stressful situation--for example, rushing through an exam).

Thus, this has attracted the attention of many researchers to examine the factors leading to stress among engineering students.

1.3 Causes of Stress

The various causes of Stress are explained as below

1.3.1 Academic Causes

Engineering curriculum is associated with continuous evaluation system, focusing on assignments, quizzes, presentations, projects along with regular written semester exams. Academic institutions have different work settings compared to non-academic and therefore one would expect the difference in symptoms, causes, and consequences of stress in the two set up. Stress seems to be very common in college students' life. They have to survive academically and to prepare themselves for further career. Not surprisingly, much of the academic stress at graduate level is related to what students learn and how they learn it. There's a lot of pressure for the present generation management students to learn more and more than the past generations. Just as it can be stressful to handle a heavy and challenging workload, some students can experience stress from regular academic work that isn't difficult enough. For the present study, the components of academic activity are identified as – curriculum and instruction; team work; assessment and placement. The present study attempts to find out which of these aspects are creating stress among management students.

1.3.2 Financial Causes

One of the major reasons for stress in University life could be high career aspirations. Thus, it is important to consider the financial aspirations and stress, i.e., how financial aspirations affect stress. With globalization, there are swings in placement. However, overstress causes problems that can have serious effects on people. Being a student, can be most interesting time of one's life. New friends, new places, new challenges can make a student life stressful. Stress management encompasses techniques to equip a person with effective management mechanisms for dealing with physiological stress.

1.3.3 Personal Causes

Personal difficulties at home, in relationships, and workplace can lead to occurrence of stress. Family "well-being" constitutes equilibrium in relationships, ability of family members' to meet crucial characters at home, imbibing right values and practices during

child rearing including the psychological and external health and development of everyone in their family. Adolescence age is prime cause amongst the students for personal stress.

1.4 Strategies for Managing Stress

Regarding strategies to manage stress, researchers come out with diverse ways to tackle this. Some researchers focus on enhancing the co-curricular activities like games, promoting societies where students can give vent to their energies by pursuing the activities of their choice. Shaikh *et al.*, (2004) reported that sports, music and hanging out with friends were common coping strategies for reducing stress. This will act as stress reliever and thus could enable them to pursue studies with increased concentration.

A healthy lifestyle is an essential companion to any stress-reduction program. Ultimately high level of stress is likely to affect the health of the students (Elizabeth, 2003). Effective time management strategies are frequently suggested by academic assistance personnel as aids to enhance achievement for college students and they increase academic performance (Campbell and Svenson, 1992).

There are other researchers who suggest yoga and meditation to cope with this issue. This paper is focused on these exercises to reduce stress amongst students. Stress management is a combination of exercise programmes viz. meditation, yogic postures, relaxation techniques, behavior and attitude modification therapies and change in lifestyle. A very important aspect to manage the stress in one's life is to change the attitude. This means one must have a positive attitude, i.e. one should always think positive. Stress management is not a ritual rather it is a holistic system that balances one's physical, psychological emotional and spiritual well-being. It helps to attain better state of concentration, peace, operational efficiency and patience.

Yoga, is a way of life, is characterized by balance, health, harmony, and bliss (Nagendra, 1977). Meditation is the seventh limb of Ashtanga Yoga, (Tamini, 1961) a state of alert rest as stated by Maharishi Mahesh Yogi, (Maharishi, 1972) who founded a new technique of meditation, popularly known as transcendental meditation. By practicing yoga, a person is supposed to reach a state of mental equanimity, where responses to

favorable or unfavorable external events are well under the individual's control, and responses are moderate in intensity (Telles, 2000).

The science of yoga is a powerful stream of knowledge, which enables the practitioners to achieve radiant physical health, serene mind, continuous spiritual uplift, and creates the ability for harmonious social living (Kumar, 2005). Hatha yoga practices, like asanas (i.e., postures), pranayama (i.e., breathing practice intended to influence vital forces), kriyas (cleaning processes), mudras (i.e., certain interval attitudes), and bandhans (i.e., neuromuscular locks) are mostly taught as physical practices. While various meditational techniques work at the mental level, all these practices are intended to develop a certain type of awareness within oneself, which in turn brings about a change in emotional and visceral functions, and through them, a change in intellectual and somatic functions of the individual takes place (Bhole, 1977).

Manocha (2000) represented meditation as a clear experience as well as distinct state of “thoughtless awareness” or ‘mental silence’, in which without decreasing the level of alertness, the activity of the mind is minimized. Meditation is the methodical expansion of human consciousness beyond acquired beliefs and attitudes about life so as to encounter a deeper reality directly (Barnes, 1997). To evaluate various psychological and behavioral effects of meditation, numerous scientific investigations have been conducted. Brown, Forte, and Dysart (1984a, 1984b) conducted experiments on visual sensitivity among Buddhist meditation practitioners using before-after and control group design. Post test was conducted after three months of rigorous meditation practice. Visual sensitivity was measured by detection threshold and discrimination threshold using simple light flashes. They reported significant improvement in visual sensitivity after the meditation retreat.

Other studies also reported similar decrease in visual threshold and increased auditory acuity after the meditation (McEvoy, Frumking, and Harkins, 1980; Keithler 1981). Other studies reported increased visual imagery abilities (Heil, 1983), enhanced attentive ability (Linden, 1973), reduction of perceptual noise (Walsh, 1978), increased reaction time (Robertson, 1983), and enhanced perceptual motor speed (Jedrczak, Toomey, & Clements, 1986). Jedrczak, Toomey & Clements, (1986) reported that higher

performance on nonverbal intelligence test was anticipated after practicing TM for a few months.

These results have been corroborated by Verma, Jayashan & Palani, (1982), reporting improvements in cognitive abilities. Studies on TM practitioners generally reported to have positive impact on intelligence, school grades, learning ability, short and long term memory (Cranson *et al.*, 1991). Mixed results have been reported regarding creativity and meditation. TM researchers reported enhanced creativity with TM practice (Ball, 1980; Orme-Johnson & Granieri, 1977). However, other researchers could not find any relationship between meditation and creativity (O'Haire & Marcia, 1980; Domino, 1977). Self actualization is thought to be the major goal of dedicated meditation practitioner. Various studies have measured several aspects of self-actualization and experiences in meditation. Gelderloos *et al* (1991) performed a meta-analysis on 42 studies on the effects of TM and other forms of relaxation on self-actualization. Their measure of self-actualization included three independent factors: affective maturity, integrative perspective on the self and world, and resilient sense of self. They found effective size of TM on self-actualization is approximately three times larger than other forms of meditation and relaxing practices. Other studies also reported increase in various dimensions of self-actualization with meditation (Gelderloos, Walton, Orme-Johnson, and Alexander, 1990).

Stress is a response to a real or imagined event which alters the normal functioning of the body. It is body's natural reaction to both the physical and psychological changes. It produces a number of undesirable effects both at physical and mental level. Joshi et al. (2008) detected undesirable effects of stress both at physical and mental level. When acoustic Meditation drills were applied to control stress, 95% population showed the positive results as gain of stress relief.

Meditation is an emerging tool of Human Resources Management in modern organizations. It is very much helpful to solve several problems of the employees as well as organizations by enhancing the overall efficiency of the both. Meditation is helpful in eradicating the interpersonal/organizational conflicts at the workplace. Joshi et al. (2010) found acoustic Meditation quite effective in achieving the control over various

personality traits. It was noticed that 95% of the subjects benefitted in terms of Arrogance relief, 90% towards Confidence, 70% for Optimism plus 85% towards Patience.

Engineering Education is a field of vast diversity and this being ever-demanding field of science and technology, the mediocre students find it hard to come up with the increasing demands of engineering curriculum. It is important to improve the performance of an engineering graduate to help him develop in an all-round personality and a thorough professional in his respective field. Joshi et al (2008) dealt with the effect of meditation on the Analytical power, Memory power, Concentration and Examination Performance of engineering students. The effort provides a useful insight into the technique of meditation to be implied for improving the performance of an engineering graduate. As per the results obtained, after carrying out exhaustive study, authors are encouraged to share this technique to be used by students to achieve excellence in the academic field of engineering.

1.5 Measurement of Stress

Although there is no direct measurement of stress possible yet the physiological parameters like GSR, Blood Pressure, Pulse Rate etc. are the indicators of stress as reported by researchers (Angus, Zhai and Barreto, 2005; Zhai and Barreto, 2006; Shi *et al.*, 2007). GSR is a method of measuring the electrical conductance of the skin, which varies with its moisture level. The GSR meter, is a biofeedback monitoring device designed to detect a person's mental state or change of state. The other device which is used for stress evaluation is sphygmomanometer, which measures blood pressure and pulse rate.

1.6 Rationale for the Study

Stress has become a major concern worldwide in recent times due to change in life style and the work environment around us. The review of literature shows some progress in the field of stress and its management. However, there is relatively scant literature available on monitoring stress through digital electronic meter. The present research aims to monitor stress through digital electronic meter and suggest remedies for managing it.

Moreover, in the present study, this strategy is going to be tried to manage stress of Professional Engineering students and to suggest suitable techniques for managing stress.

This will help these students to perform better and emerge with enhanced skills to brave the competitive job scenario.

There is no provision in the educational institutions to test the parameter of mental stress of students electronically. This may bring revolution towards the productivity enhancement of the students scientifically. Unfortunately, now a days our youth are addicted to drugs to get relief from tension, stress, depression etc. If the students experience the effects of mind power techniques and monitor the results instrumentally, this will result in proper channelization of their energy and this is precisely the need of the hour too.

1.7 Objectives of the Study

Thus keeping these in mind the present study has been taken with the following research objectives:

1. To identify factors leading to Stress in Engineering Students of Thapar University, Patiala and Punjabi University, Patiala.
2. To measure stress through GSR (Skin Conductance) to identify students with high stress level.
3. To Monitor Stress Level using Digital Electronic Instrument (GSR meter) through various Stimuli under studies.
4. To find out the most effective Stimuli under studies of Handling Stress of Engineering Students.

1.8 Implications of the Study

Academic Stress can severally hinder academic performance as well as adjustment in life. The suggested research will help to reduce stress, improve efficiency and productivity of the engineering students. This endeavor may help in plummeting bad habits that emerge from stress like drug addiction, smoking and drinking. Their physical and mental health will improve. This study can be extended to students of other colleges and public

enterprises. The study will also be extremely useful for students of Medical and para-medical sciences. The suggested techniques can be adopted for management of stress in educational institutions.

1.9 Organization of the Thesis

The significant task involving any research study refers to the proper and logical presentation of the data concerning different aspects so that required weightage to every aspect can be observed. For all the respondents, it was first time that they were sharing their experiences and perceptions regarding something, which constitute an integral part of their daily life. So, this resulted in collection of immense amount of data, which was then analyzed to present the findings of the research problem. In order to present discussion in a lucid style, the final presentation of the study has been divided into the following five chapters:

Chapter-1 includes the introduction about the topic, and provides the information about the Engineering Education Scenario in India and the types of the stress engineering students have to undergo, a brief about Strategies for Managing Stress along with the main objectives of the study.

Chapter-2 deals with the review of literature. The theoretical ideas and empirical views of the various researchers are presented and explained as Academic Causes, Financial Causes, Personal causes, Stress Relieving Strategies, and Measurement of Stress

Chapter-3 covers the research methodology which provides the layout of research.

Chapter-4 deals with analysis and discussion. This chapter covers all the variables which are important to the study.

Finally **Chapter-5** covers the summary and conclusion of the study. This chapter also covers the limitations of the present study, the stress management strategies and the

recommendations and the future scope of the study. It also covers Significance and Implications of the study.

1.10 Concluding Remarks

An attempt has been made for proposing a stress monitoring and management module for studying causes of stress amongst students with theoretical and experimental verification for monitoring and management of stress. Through this chapter a brief outline of research has been drawn, focusing on engineering students stress. Literature Review is a prior condition for a planned and ordered research process and hence the succeeding chapter is focusing on the contribution of various authors in the direction of causes of stress and its measurement techniques.

CHAPTER – 2

REVIEW OF LITERATURE

Scrutiny of literature related to any sort of research work is important event which is helpful for the researcher to gain deep outlook on the theme to roll out the pitfalls and stones as it might be experienced by earlier ones. So mapping and implementing of any quest should be moved along complete scrutiny of literature on related theme. Scrutiny of literature will:

- a) get acquainted with previous researches done on the theme.
- b) Reduces the duplicity of task done previously.
- c) Equip with important knowledge on research tools that could be used.

Six sections have been framed in this chapter for researching the earlier studies carried out in following areas:

2.1 Academic Causes

2.2 Financial Causes

2.3 Personal Causes

2.4 Measurement of Stress

2.5 Strategies to Overcome Stress

2.6 Research Gaps

2.7 Concluding Remarks

2.1 Academic Causes

Engineering curriculum is associated with continuous evaluation system, focusing on assignments, quizzes, presentations, projects along with regular written semester exams. Multitasking curriculum like this is a cause of stress among engineering students (Kjerulff and Wiggins, 1976; Kolko, 1980). Working on projects requires regular interaction with teachers. Shyness, lack of practical skills and training, as well as larger class size acts as a deterrent to interact with teachers. Many researchers have pointed out that discussion, debate, questioning and explaining support active learning (Cohen, 1994; Matthews, 1996).

But in many universities due to larger enrolments active engagement and discussion is becoming impossible. Degree holders hardly secure time or an opportunity to develop interpersonal relationships (Hartshorn, 1976). Studies by Steers (1984) and Mottowildo (1986) unfold that even minimal levels of stress can check the creativity of work. Sailer (1982) opines that cognitive reactions of stress decrease the capacity to concentrate. Thus it is imperative to focus on strategies for reducing stress amongst engineering students. Many of the Young engineers lack social adjustments and lead life full of stresses and strains (Leong & Mallinckrodt, 1992).

Lazarus & Folkman (1984) describe as stressors amass an individual's ability to envisage can be overtaxed, paralyze their physical or psychological resources. Essandoh (1995) found College a mess of stress for students who learn different cultural values and language along with academic preparation. A number of studies have weighed the impact of stress on college students (e.g., Kohn & Frazer, 1986, Edwards, Hershberger, Russell, & Market, 2001; Misra, McKean, West, & Russo, 2000; Reifman & Dunkel-Schetter, 1990; Zaleski, Levey-Thors & Schiaffino, 1998 ; brown (1992). Family-related pressures, scholarship requirements, financial burdens, academic competition, multitasking curriculum are the stressors borne by the college students (Cheng, Leong, & Geist, 1993). And it is enhancing day by day (Sax, 1997) Academic stressors include the student's perception of the extensive knowledge base required and the perception of inadequate time to develop it (Carveth, Geese, & Moss, 1996).

Academic stress is being found in the students in taking and studying for exams and with respect to grade competition and to grasp curricular content with stipulated time (Abouserie, 1994). The perception of excessive or negative stress by the students experience physical and psychological reactions to stressors. It may induce physical impairments, and it is quite common to find students with persistent lack of energy, loss of appetite, headaches, or gastrointestinal problems (Winkelman, 1994). In addition, some international students may somaticize their feelings of stress to avoid the stigma of seeking psychological assistance (Mori, 2000). Students observing headaches, loss of appetite, or insomnia show the stress experienced by the students. Sailaja (2002) investigated the Cultural Differences in Stress and management Strategies of stress of Adolescents of two cities of North and South India.

Rawson (1994) and other scholars also support that the stressors like academic , social , life and economic factors, and career factors create mental stress among the college students. According to Nandamuri and Gowthami (2011) academic stress experience both positive and negative sequels if not well administered. There is a lot of difference of work setting in academic and nonacademic aspects. So as a result of this fact symptoms & causes also vary. Stress is quite common among collegiate. They have to struggle for academic performance and career. They are pressured to learn more and equip them with latest strategies, current affairs apart from regular academic work. All these factors make the management students more stressful and hard to handle the components of academic activity.

The components of academics, in general, taken as curriculum and instruction, team work, assessment and placement. Among these components, curriculum and instruction aspects were found to be largely responsible for stress (86%) among the management students. and assessment related matters at 41% and the team work issues accounted for around 24%. The study could list out twelve sub issues related to curriculum and instruction component of academic stress ranging from regular attendance for the class work (68%) and achieving academic goals (64%) to keeping up with regular reading (19%) and learning all material at 16%. Among the team work related stressors, adjusting with the group mind set was given high score by 61% of the students followed by communicating with the members of the group (52%). Meeting deadlines of assessment was the highest stressor (82%) among the issues of assessment. Other major issues responsible were lack of clarity (72%), high weight age components (66%), and getting good grades (62%).

2.2 Financial Causes

One of the major reasons for stress in University life could be high career aspirations. Thus it is important to consider the financial aspirations and stress, i.e., how financial aspirations affect stress. With globalization there are swings in placement. The recent recession of 2007-08 also had resulted in poor placements as the recessionary trends in USA and Europe lead to a steep fall in requirement for engineers. The scene of scarcity of jobs has also been enhanced due to increase in no. of Institutions. The students have

to join many courses to achieve placements in multinational companies and to combat the race in corporate sector. And it's natural, this competition makes them stressful and create anxiety among the students. It is largely responsible for stress up to 63%.

Moreover the studies say that 90% of the students undergo stress while facing placement interviews. They prefer to work according to their preferences. The place of work is considered to be secondary stress factor for around 50% whereas job profile is tertiary stressor for about 30% of the sample group. It is found that related issues to placement, 88% of the sample felt that appearing for interview was the cause of stress whereas around 50% were being stressed for issues related to the pay package and job location (Nandamuri and Gowthami, 2011). It is apparent that over stress makes the people to lead a dull life full of strains. Although Student life is the most enjoyable time of life but now a days, students are subjected to meet challenges of adjustments with new friends, places, and competitions etc. They have to learn stress management for their survival in present scenario. As said by Goodman, 1993. Stress management encompasses techniques to equip a person with effective mechanisms for dealing with physiological stress. Students have different expectations, goals, and values that they want to achieve, which is only possible if the students expectations, goals, and values are integrated with that of the institution (Goodman, 1993).

This highlights the need to focus on the causes that leads to stress in engineering students. Stress is generally aligned with the discipline and thus in this study focus will be on causes of stress related with engineering discipline. There are few studies focusing upon financial aspirations and stress, thus it needs more introspection and analysis. There have been numerous studies on understanding measurement of Stress. The following section is related with studies on measurement of Stress.

2.3 Personal Causes

Stress may be flamed out of the home environment, workplaces, weak relationships, lack of understanding among family members, friends, and colleagues at work place etc. Inability to shoulder the responsibilities at home or workplace can stress a person. An Adolescence age is prime cause amongst the students for personal stress. Kai-Wen, C. (2009) pinned the sources of stress among college students in Taiwan.

He quoted that Family factors strongly stress the male students than female ones; and The students in higher grades become more stressful physically, mentally, emotionally and school factors. Moreover loan taken by students gain the same kind of stress as in higher grades. Putwain, D. (2007) explored that the personal causes also create anxiety among the students.

2.4 Measurement of Stress

This has attracted the attention of eminent researchers from India and other countries of the world, who have significantly contributed to literature. It is important to have a brief overview of these studies to get more insight into the problem. Kosuke and Yosiko (1968) performed study of measurement of mental tension with biomedical instruments. The Electroencephalogram, showed a decrease in α wave and an increase in β wave at initial stage of tension experienced and the Galvanic skin reflex, showed more frequent appearances and larger amplitude at initial stage. The Micro-vibration, showed a decrease in α wave and a conspicuous increase in θ wave with increase in level of tension. The plethysmogram, showed more frequent oscillation of the standard line, but smaller amplitude with The Pneumographic study,, showed an increase of frequency in breathing with the beginning of tension,

Benson et al (1973) found high Blood Pressure decreased in people meditated, even in Hypertensive issues. Goleman and Schwartz (1976) discovered that practice of Meditation is an Intervention in Stress Reactivity. Pagano and Frumkin (1977) monitored the effect of Transcendental Meditation on right hemisphere functioning, Biofeedback and Self Regulation. Carrington (1980) observed Meditation practice can be adopted as effective Relaxation chic to control Stress in wage earners.

Wood et al. (1984) performed Cold Pressor test to predict hypertension. Early hyper reactivity was observed in many subjects which suggests that an abnormal response to an external cold stimulus may be useful as an indicator of future hypertension. Sahasi et al (1989) found yogic techniques are highly effective in the management of anxiety. Haratani and Henmi (1990) observed the effects of Transcendental Meditation on mental health of industrial workers. Women bear more stress as compared to men (Hyde & Plant, 1995; Thomas & Williams, 1991).

Stressors are responsible for physical or psychological arousal that usually results from the perception of stress (Thoits, 1995). Burns et al. (1999) found that, both finger temperature and skin conductance decreased over time. Across emotional conditions, self reported relaxation was lowest for rock listeners and highest for participants in the self selection and silence conditions. Academic Stress shows a great impact on physical health even though it is not predictable on organic basis (Khoo, Abu-Rasain, & Hornby, 1994).

Tripathi (1993) conducted a study on Police Organisation in Uttar Pradesh on Stress, Health and Performance to pin the causes of stresses in Uttar Pradesh Police force and suggested remedial interventions to minimize the stress among the police personnel. It was recommended that structural changes should be altered to decrease long term stress from work and family services. The researchers suggested that psycho-social prevention program should be introduced with the thrust on enabling vulnerable persons to avoid unchangeable stress and increase their stress resistance. Saha et al. (1996) observed the increase in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and decrease in galvanic skin resistance (GSR), auditory and visual reaction time (ART and VRT) in workers envisaging noise stress. Channabasavanna (1996) conducted an epidemiological study to identify the magnitude of few mental health problems among police personnel. Keeping in view, it is recommended that Psychologists, Psychiatrists or Counsellors should be posted in Police Hospitals for counselling, identifying and minimizing stress in the force. The sensitization of Police officials were recommended for identifying stress related problems in their Force and to enforce the different stress management techniques.

Naveen et al. (1997) found that practice of deep Breathing through a nostril increases memory power. Telles et al (2000) proved that Yoga postures along with supine rest (in Cyclic meditation) minimize the oxygen consumption more than resting supine alone does. Music communicates through the combination of sound and lyric (Sellnow & Sellnow, 2001). Listening to relaxing music yields higher perceived arousal as compared to the absence of music (Davis & Thaut, 1989).

Sudheesh and Joseph (2000) investigated the influence of music and meditation on galvanic skin response and illustrated that this instrument is a source to investigate mental state of an individual during music appreciation.

To study the impact of music on an individual is important from research point of view especially for emotional response, relaxation, and anxiety. Recent study explores that with increase in tempo while listening to a Mozart sonata, strain of listener is increased and decreased with moderate tempos (Krumhansl 2002). It is also manifested that music enhances the learning capacity and retention power. They are interconnected processes in the brain (Trappe 2010). Several researches on musical impact have been made which lead to research at cellular level.

A number of recent studies reflect that the music can be used as therapy to cool down the stress because it touches at the physiological level of the individuals. Trappe (2010) claimed that patients with anxiety, mental anguish, depressive syndromes, and insomnia can be relaxed by listening classical music as it normalizes heart rate and blood pressure whereas music with fast tempos create negative influences on heart rate and blood pressure. Iwanaga and Youko (1999) showed that patients' pre-surgery anxiety can be lessened if they are made to listen music. It is proved by measuring their high blood pressure and heart rate. The Participants preferred higher tempo music while exercising, showed an increase in physiological arousal (Karageorghis, Jones, and Low 2006). Edworthy and Waring (2006) studied the impact of different tempos of the music on participants. They observed a significant difference of the heart rate of participants who exercised with listening music with fast tempo and slow-quiet music. Rutschman (2004) studied the effects of meditation and relaxation on attention. Meditation practice tends to increase attention, flexibility and sustainment. Misra et al. (2004) signifies in her research that there is a lot of difference in perceptions of American and international student participants in terms of reactions to academic stressors.

Mehra (2005) carried out project on Stress Management in the CPMFs. Possible causes of stress were identified which concluded that all CPMFs were aware of stress and its related problems affecting their personnel. It was recommended that the Government should set up central organization on Mind Body Medicine for research and its application (Mishra, 2007).

There is an important relationship between the three i.e pranic healing and blood pressure and alpha waves. Granath (2006) indicated that cognitive behaviour therapy and yoga are strong stress management techniques. Chanavirut et al. (2006) found that short-term Yoga exercises are very helpful for the improvement of respiratory capacity, chest wall expansion and forced expiratory lung volumes. Richard & Antoine (2007) detailed that the people used to meditate for tens of thousands of hours, succeeded to alter the capacity of their brains functionally and structurally. Chawkin and Blackford (2009) proved transcendental meditation is one of the powerful tool to reduce systolic pressure instead of other stress decreasing tools.

Anderson (2008) proved Patients with high blood pressure can reduce systolic and diastolic blood pressure with regular practice of Transcendental Meditation by ~4.7 and 3.2 mm Hg, respectively. It can be considered as clinically meaningful changes. Research by Allison (2008) shows control of Blood Pressure through 'Om Meditation.' It was found clinically significant, when applied on the people suffering from hypertension. Gurjar and Ladhake (2008) illustrated the magic effect of chanting Sanskrit Divine Mantra 'OM'. The study aimed at to find out the magic effect of this mantra. With ripple transforms, and time-frequency analysis had been drawn for the divine sound OM. It is scientifically proved that recitation of mantra OM can pull down the level of stress magically.

Shankar et al. (2008) investigated the changes in GSR during hypnotic analgesic condition and found a clear relation between Pain and GSR. It established a scope for measuring pain objectively using GSR. Joshi (2008) detected undesirable effects of stress both at physical and mental level. When acoustic Meditation drills were applied to control stress, 95% population showed the positive results as gain of stress relief. Adhikari (2008) studied the effect of yogic exercises on occupational stress among Indian Army Personnel. The study explored the effect of a Yoga Training Program (YTP) on occupational stress (OS) among Indian army personnel at 4th Battalion Rajput Regiment, Sahajahapur, UP. Results unfolded that participants pulled down stress at place of work. It was statistically very significant.

Al Sears (2009) found in studies (sampled with 111 men and women with age group 55 and 85 hypertension history) that meditation is very effective for lowering down blood

pressure as medication. Nandre, (2009), applied non-bio-pharmacological approach to control hypertension by yoga on eleven hypertension patients of variable age groups. It was noticed that majority showed almost normal blood pressure after practicing yoga. All these patients were advised to stop the allopathic medicines and inspired to continue the Yoga. Nilsen (2009) verified influence of Motivation, Self-Efficacy and Value-Expectation on student academic behaviour. The researchers suggested that universities should focus on pedagogical learning, strategies to increase students learning, influence student academic behaviour. Gaur (2004) investigated the effect of Preksha Meditation to decrease the level of stress in teenage students. The subjects experienced a reduction in stress in the areas of academy, family and achievement. There was a reduction in their anxiety and frustration level.

Gurjar et al. (2009) did analysis of acoustic of “OM”. He studied its impact on one’s nervous system. With proposed algorithm, investigation was carried out for the divine sound OM. It was found that OM Chant serves as a brain stabilizer, a energizer for a person prone to stress. Kauts and Sharma (2009) suggest that the pupils practising yoga show amazing results in academics. Their study further carries the facts that the students with minimal stress showed better performance than the students with high-stress level.

Joshi (2010) found acoustic Meditation quite effective in achieving the control over various personality traits. It was taken into notice that 95% of the people gained in terms of Arrogance relief, 90% achieved Confidence, 70% enhanced in Optimism and 85% in terms of Patience. Extending the study further Joshi (2011) proposed the Development of Stress Management Laboratory in India for Monitoring of Physiological parameters leading to mental stresses for Human Resources of corporate.

Hussain and Bhushan (2010) studies depict that meditation creates positive effects on human physiology like heart rate, metabolic activities respiration, skin resistance etc. but it is limited to those people who are psychologically sound, may show the symptoms of mild neurosis or psychosomatic disorders. They also studied the future directions of meditation and its impact on health physiologically. Mohan et al. (2011) studied the effects of meditation on stress-induced changes in cognitive functions.

They practiced meditation and got the physiologic stress responses reduced and memory scores improved. Joshi (2011) strongly proved the effect of practice of Nadi Shodhan

Pranayama (NSP). It generates the feelings of well-being, improves retention, mental and physical relaxation. The research showed that 75% of the subjects gained in terms of Feeling Healthy, 80% improved their retention, 75% accrued Mental Stress Relief and 90% gained Physical Relaxation. Kauts and Sharma (2012) analyzed that the students, who practiced yoga module yielded higher concentration levels and exhibited better short term memory. Bishayee (2012) explored job-stress of faculty members in private professional colleges located in NCR, Delhi. The results show that most of the faculty members experienced moderate degree of job stress. Moreover, Sandanger et al (2004) examined that the younger women were more stressed than the men of peer group for events like relationship, illness and network.

Kai-Wen (2009) investigated the sources of stress among college students in Taiwan and found that the male students feel more stressed from family factor than female ones.

After understanding the literature on reasons for stress, it is important to study literature on strategies used for management of stress. The below Section focuses on literature related with stress coping strategies.

Many students find college life full of stress and strains as they have to adapt to educational and social environments with novelty. Our present educational system has become mechanical and it fails to nurture an all round development of the personalities of the students. Also relationships among life stress, social support and academic stressors were investigated by Misra *et al.*, (2003). Important differences in perceptions of academic stressors and reactions to them amongst student participants were found by Misra et al. (2004).

Joshi *et al.*, (2011) had proposed the Development of Stress Management laboratory in Indian educational institutions. In these laboratories, modern electronic instruments as well as some scientifically proven stress relaxation therapies should to be used for Monitoring of Physiological parameters leading to mental stresses for students. Since the stress or depression in students may force them to hook on to drugs or to commit suicide, due to poor grades or any other reason, Rao, Yogita (2015) focused on latest suicidal measure taken by IIT-Bombay, which has proposed to set up a committee to look into the changes that need to be brought about in the counselling services offered by the institute. Also many researchers studied the applications of Psycho physiological analysis.

Brown (1967), the Society of Psycho physiological Research published a proposal for a standardized terminology that has been widely accepted. The GSR analysis under various stimulus, has been used by many researchers. Aberg (2005) depicted the empirical study of electrical changes in human skin. Kreibig (2010) studied that the concept of emotion, expressive behaviour such as smiling and with peripheral physiological responding such as heart rate changes, sweating and skin resistance changes are associated with emotional aspect. This study evaluated the functioning of the autonomic nervous system (ANS) in response to an emotional stimulus.

Physiological parameters like GSR, Blood Pressure, Pulse Rate etc. are the indicators of stress as reported by researchers (Angus, Zhai and Barreto, 2005; Zhai and Barreto, 2006; Shi *et al.*, 2007). GSR sensor meter shows success rate of 76.56% (Villarejo *et al.*, 2012) to explore the different states of each user. GSR requires the presence of active sweat glands, (Boucsein, 2012). The sympathetic nervous system brings them in action. It is believed that sweat rises in ducts, spreads laterally, hydrating the stratum corneum and reduces its resistance thereby increasing conductance. Montagna (2012) found (other than sweat gland activity) the epidermal membranes of the skin becoming permeable in response to neural stimuli have also been considered to decrease the skin resistance GSR is used as the physiological measure in this experiment.

Wiech & Tracey (2009) discovered the importance of sensory processes in behaviour and emotional experience is the subject matter of psychophysics. The relation between Meditative techniques like Abdominal Breathing, Buddhist mindfulness, transcendental meditation etc. and its effects on Physiological parameters like GSR (stress) has already been established in past. Meditation (Snyder, 1990; Woodhouse, 1994; Stanley, 2012) is also known to have a remarkable effect on the mental state of practitioners. Many scientific studies have been conducted on its ability to reduce stress. Jerath *et al.*(2006). And Wallace (1970) studied that skin conductance vary during meditation.

It yields a continuous measure that is related to activity in the sympathetic branch of the ANS (Figner & Murphy, 2010). Obrist (1963) concluded that the magnitude of the skin resistance difference was significantly reduced in the subjects during stimulation. Researchers Brown (1967) and Villarejo *et al.* (2012) have reported that GSR is further a function of stress. It yields a continuous measure that is related to activity in the

sympathetic branch of the ANS. Salam (2013) described GSR, a well-known somatic marker, may be useful in monitoring objective bodily response during music experience.

2.5 Strategies to Overcome Stress

The various co-curricular activities like games, music, promoting societies where students can give vent to their energies by pursuing the activities of their choice may help to reduce stress level. Here two techniques of yoga and music are explained.

2.5.1 Deep Breathing

Bernardi et al. (2000) explored how breathing and mental stress affects the Heart Rate Variability (HRV). Kaur *et al.* (2001) investigated the Effects of Yogic Exercises with deep breathing on Physiological Parameters in Women and found the results highly encouraging. So in this experimental analysis it has been proved that, GSR biofeedback with deep breathing can be recommended as effective stress monitoring and distressing technique. Researchers have proved that deep breathing as well as other yogic exercises can reduce distress positively. Chang (2014) did research and found that a ten week Tai-Chi and Yoga educational training program which includes deep breathing, which have a positive influence on antioxidant capacity and oxidative stress measures and is effective for improving health fitness for females.

2.5.2 Music

Since ancient times music plays an important role for stress management. It is proved that music and medicine in combination is a boon to cure many physical diseases and disorders (Sharma, 2007). Music is an art, and classical music got recognized around 11th century and gained popularity due to the systematic notation.

The music creates magical influence on mind and freshens it. Many of the people relish to listen music from morning till night. Classical Music soothes the brain greatly; it positively effects the human's hormone system that's why people feel relaxed after hearing the classical music.

We know India has strong historical background of music. Trappe (2010) studies have proved that many kinds of disorders like anxiety, pain, stress, depressive syndromes and

sleeplessness in human beings will be cured by listening music. It can decrease the heart rate and blood pressure to normal.

2.6 Research Gaps

Though there is rich literature available on measuring stress and hypertension and effect of yoga and meditation on controlling them. This has lured ample researchers from the world to pursue research in allied areas. Thus there are many national and international studies on understanding the impact of yoga and meditation in reducing hypertension and stress. But still as is obvious from the literature review that there are a very few researchers working on instrumental analysis of these aspects. The present study proposes an instrumental research after analyzing the same through survey based analysis. Thus, this will lend a new direction to this area.

2.7 Concluding Remarks

Review of literature chapter throws much light on research studies carried out in the field of stress. Based on review, research gaps have been identified. It has highlighted the significant changes in stress overcoming techniques. The review has helped in the choice of stress management techniques and its monitoring through instruments. Next chapter focuses on research methodology incorporated in the study encompassing research design and research methods that have been used to accomplish the objectives.

CHAPTER - 3

RESEARCH DESIGN AND METHODOLOGY

This chapter includes phases of research to explain the complete process engaged to achieve the objectives of the Research. The chapter encompasses defining objectives of the study, development of hypotheses, research design, sampling design along with methods undertaken for data collection, selection of sample and survey areas and the relevant selection of appropriate statistical methods for data analysis and its interpretation.

Section 3.1 defines the objectives of the study; Section 3.2 covers the Theoretical Framework; Section 3.3 presents the phases of research; Section 3.4 presents research design and research methods covering sampling design, data collection, questionnaire, reliability and validity, methods and techniques; Section 3.5 presents experimental research framework; Section 3.6 covers conceptual research model and Section 3.7 has concluding remarks.

3.1 Objectives of the Study

The initial phase of every research process is defining the objectives of the study. Review of literature helped in identifying the research gaps and indicates a need for research in current area. The following objectives have been defined for the present study:

O1: To identify the factors leading to Stress in Engineering Students of a Government University (Punjabi University, Patiala) and Private University (Thapar University, Patiala)

O2: To measure stress through GSR (Skin Conductance) to identify students with high stress level.

O3: To monitor stress level using Digital Electronic Instrument (GSR meter) through various Stimuli under study.

O4: To find out the most effective Stimuli under study for handling Stress of Engineering Students.

3.2 Theoretical Framework

The frame work is described as below

3.2.1 Hypotheses Development

This section covers the hypothesis development. A research study is a co relational study when the researcher demarcates the key variables linked with the study (Cavana *et al.* 2001). The types of stress considered in the study are: Academic Stress, Financial Stress and Personal stress. Accordingly, theoretical framework along with related hypothesis has been presented to help in the construction of questions for these constructs. The same has been presented as following.

3.2.2 Academic Stress

Engineering curriculum is associated with continuous evaluation system, focusing on assignments, quizzes, presentations, projects along with regular written semester exams. Suri & Sharma (2014) found that there is a significant relationship between discipline and e-learning attitude of students as depicted by previous researches. These researches lay emphasis on the role of department in learning and satisfaction level of students. Academic institutions have priorities and quite different from non-academic activities. Therefore, one would experience the difference in symptoms, causes, and consequences of stress. Stress is very common in college going students. Their struggle for survival academically, professionally makes them to lead stressful life. They have work hard to achieve their goals. There is a lot of pressure on the students to learn more than past generations and how they learn it. They experience stress from regular academic work, moreover it is too difficult for them to manage stress generated from these workloads and challenging tasks.

Academic stressors include overload of assignments, peer competition, poor relationships with teachers (Fairbrother & Warn, 2003); grade competition (Abouserie, 1994); inadequate resources to perform academic work (Awino & Agolla, 2008) and fear

of academic failure (Kolko, 1980).

Singh & Singh (2013) highlighted that there were significant differences among school, college and university level sports persons on almost all traits of personality, except dominance. Jacobs *et al.* (2011) suggested that the Wii Fit exercise should be considered by occupational therapists as a potential occupation of weight control in undergraduate students to improve performance. Wii Fit exercise uses a unique platform peripheral called the Wii Balance Board, on which the player stands during exercise. This features yoga, strength training, aerobics, and balance games. For the present study, the components of academic activity considered include: curriculum and instruction; team work; assessment and placement. Ramayah, Yeap & Ignatius (2013) revealed that extrinsic motivation, reciprocal relationships, sense of self worth and subjective norm are vital determinants of an academician's attitude towards knowledge sharing. The present study attempts to find out which of these aspects are creating stress among management students.

The components of academics taken include curriculum and instruction, team work, assessment and placement.

H₁: There is a significant difference in the academic stress based on gender, age, engineering streams and nature of university.

H_{1a}: There is a significant difference in the academic stress based on gender.

H_{1b}: There is a significant difference in the academic stress based on age.

H_{1c}: There is a significant difference in the academic stress based on engineering streams.

H_{1d}: There is a significant difference in the academic stress based on nature of university.

3.2.3 Personal Stress

Stress can be attained from personal responsibilities at home, in relationships, and at the workplace. Family "well-being" includes stable and cordial relationships, fulfill domestic responsibilities, child fosterage, and development of family members with sound mental and physical health. Hough (1996) focused on rewarding because it can provide real improvement in the lives of people who have become entangled in a web of inactivity, low self-esteem and helplessness.

Belwal & Belwal (2014) suggested that family-friendly policies facilitate the employees to nurture their families efficiently along with fulfillment of responsibilities at their work place, create flexible-work conditions and enhance the capacity of women to perform better on both domestic and work fronts. Kaur and Kaur (2002) accentuated on the critical issue of child labour in India and suggested to bring change in social attitude to overcome that. Adolescence age is prime cause amongst the students for personal stress. Singh, Darwish, Costa & Anderson (2012) focused on understanding of the HRM and organizational performance (OP) nexus by drawing attention to the complex interplay of internal and external factors affecting OP. Increased competition of the 21st century is posing difficulty amongst students in coping stress and there is increased demand to initiate such programs in the institutions to teach them to cope with these stressors (Frydenberg *et al.*, 2004). Students face social, emotional and physical stress, this in due course have repercussions on their learning skills and hinders academic performance (Fish and Nies, 1996; Chew-Graham *et al.*, 2003). The stress in undergraduate students is related with interpersonal relationships with peer ; and their difficulty in trying to adjust to the university social network (Shirom, 1986); excessive class workload (Radcliffe and Lester, 2003); perceptual differences based on age, school year, faculty and gender (Perlberg and Keinan, 1986).

H₂: There is a significant difference in the personal stress based on gender, age, engineering streams and nature of university.

H_{2a}: There is a significant difference in the personal stress based on gender.

H_{2b}: There is a significant difference in personal stress based on age.

H_{2c}: There is a significant difference in the personal stress based on engineering stream.

H_{2d}: There is a significant difference in the personal stress based on nature of University.

Thus, as explained stress is affecting students' performance and their adjustment in life. Thus, after describing the three types of stress covered in the present study, the current section deals with stress management by highlighting the stress relieving strategies used by researchers and the ones adopted in the present study.

3.2.4 Financial Stress

One of the major reasons for stress in University life could be high career aspirations. Thus, it is important to consider the financial aspirations and stress, i.e., how financial aspirations affect stress. Financial stress is quite widespread. It is not only related with getting a placement offer, but also peer comparisons of placement offers and nature of job, the reputation of organizations offering placements. With globalization, there are swings in placement and students of Engineering Institutes feel the crunch of financial stress. However, overstress causes problems that can have serious effects on people. Being a student, can be the most interesting time of one's life. Mittal, Gera & Batra (2015) opined that Organizations need to measure and manage overall service quality perceptions to build trust and reinforce loyalty intentions among their customers. New friends, new places, new challenges can make a student life stressful. It is also about fees and affordability of getting admission in good rated institution and maintenance expenditure of stay in the Institute. Also there are the consequences of repayment of loan (Draut, 2007; Harding, 2011).

Financial hitches are often related with stress (Northern, O'Brien & Goetz, 2010; Draut, 2007; Ross, Niebling & Heckert, 1999). There has been literature regarding negative outcomes of financial stress. These include i) depression (Clark-Lempers, Lempers & Netusil, 1990), ii) anxiety (Andrews & Wilding, 2004), iii) poor academic performance (Andrews & Wilding, 2004; Harding, 2011), and iv) difficulty persisting towards degree completion (Joo, Durband & Grable, 2008). Although there have been some studies on financial stress, but factors related to financial stress among Engineering students had not been analyzed and there is a need to analyze them in detail. Hence it has been included in this study. Stress management encompasses techniques to equip a person with effective coping mechanisms for dealing with physiological stress.

H₃: There is a significant difference in the financial stress based on gender, age, engineering streams and nature of university.

H_{3a}: There is a significant difference in the financial stress based on gender.

H_{3b}: There is a significant difference in the financial stress based on age.

H_{3c}: There is a significant difference in the financial stress based on engineering streams.

H_{3d}: There is a significant difference in the financial stress based on nature of university.

3.2.5 Stress Relieving Strategies

Regarding strategies to manage stress, researchers come out with diverse ways to tackle this. Some researchers focus on enhancing the co-curricular activities like games, promoting societies where students can give vent to their energies by pursuing the activities of their choice. Shaikh *et al.*, (2004) reported that sports, music and hanging out with friends were common coping strategies for reducing stress. These strategies by relieving stress could enable them to pursue studies with increased concentration. A healthy lifestyle is an essential companion to any stress-reduction program. Chittoor & Das (2007) focused on professionalization of management. High level of stress is likely to ultimately affect the health of the students (Elizabeth, 2003). Effective time management strategies are frequently suggested by academic assistance personnel as aids to enhance achievement for college students and to improve academic performance (Campbell and Svenson, 1992). There are other researchers which suggest yoga and meditation to cope with this issue. In this study the focus was on these exercises to reduce stress amongst engineering students.

Stress management is a combination of exercise programs, viz. meditation, yogic postures, relaxation techniques, behavior and attitude modification therapies and change in lifestyle. A very important aspect to manage the stress in one's life is to change the attitude. This means one must have a positive attitude, i.e. one should always think positive. Stress management is not a ritual rather it is a holistic system that balances one's physical, psychological, emotional and spiritual well being. It helps to attain better state of concentration, peace, operational efficiency and patience. Choudhary, Deswal & Philip (2013) explored the relationship between three types of organizational justice, namely, distributive, procedural and interactional justice and workplace and personal outcomes of service sector employees.

Nauriyal, Drummond & Lal (2006) demonstrated to lead contented and peaceful life by adopting the Buddhist principles. These principles will help to attain deeper understanding of human behavior. Yoga is a bliss to lead healthy life full of enthusiasm (Nagendra, 1977).

Meditation is considered to be the seventh element of Ashtanga Yoga (Tamini, 1961). It

is a state of alert rest as stated by Maharishi Mahesh Yogi, (Maharishi, 1972) who founded a new technique of meditation, popularly known as transcendental meditation. By practicing yoga, a person is supposed to reach a state of mental calmness, where responses to favorable or unfavorable external events are well under the individual's control and responses are moderate in intensity (Telles, 2000). The science of yoga is a powerful stream of knowledge, which enables the practitioners to achieve radiant physical health, serene mind, continues spiritual uplift and creates the ability for harmonious social living (Kumar, 2005).

Initially effort was made to examine if there was a difference in coping strategies based on gender, age, engineering streams and university through ANOVA.

The related hypotheses are:

H₄: There is a significant difference in the Stress Relieving Strategies based on gender, age, engineering streams and nature of university.

H_{4a}: There is a significant difference in the Stress Relieving Strategies based on gender.

H_{4b}: There is a significant difference in the Stress Relieving Strategies based on age.

H_{4c}: There is a significant difference in the Stress Relieving Strategies based on engineering streams.

H_{4d}: There is a significant difference in the Stress Relieving Strategies based on nature of university.

The next action of research focused on use of different stimuli to manage stress. These stimuli were: i) yogic exercise viz. deep breathing; ii) listening musical religious hymns; iii) listening Indian instrumental music (Flute) and iv) listening western instrumental music (Saxophone). The difference in control and experimental group was recorded through GSR (Galvanic Skin Response) and tested through t-test.

The related hypotheses are:

3.2.6 Effects of Stimuli of Music and Yoga and Stimulus of No Treatment

H₅ : There is a significant difference in the mean GSR value of control group (not exposed to undergoing yogic breathing exercise) for t=zero second (before) and t=300 seconds (after).

H₆ : There is a significant difference in the mean GSR value of experimental group (undergoing yogic breathing exercise) for t=zero second (before) and t=300 seconds (after).

H₇ : There is a significant difference in mean GSR value of control group (not exposed to undergoing yogic breathing exercise) and experimental group (exposed to undergoing yogic breathing exercise) at t = zero second.

H₈ : There is a significant difference in mean GSR value of control group (not exposed to undergoing yogic breathing exercise) and experimental group (exposed to undergoing yogic breathing exercise) at t =300 seconds.

H₉ : There is a significant difference in the mean GSR Value of control group (not exposed to listening to musical religious hymns) at t=zero second and at t=300 seconds.

H₁₀ : There is a significant difference in mean GSR value of experimental group (exposed to listening musical religious hymns) at t=zero second and t=300 seconds.

H₁₁ : There is a significant difference in mean GSR value of control group (not exposed to listening to musical religious hymns) and experimental group (exposed to listening to musical religious hymns) at t = zero second.

H₁₂ : There is a significant difference in mean GSR value of control group (not exposed to listening to musical religious hymns) and experimental group (exposed to listening to musical religious hymns) at t =300 seconds.

H₁₃ : There is a significant difference in the mean GSR Value of control group (not exposed to listening to flute music) at t=zero second and at t=300 seconds.

H₁₄ : There is a significant difference in mean GSR value of experimental group (exposed to listening flute music) at t=zero second and t=300 seconds.

H₁₅ : There is a significant difference in mean GSR value of control group (not exposed to listening to flute music) and experimental group (exposed to listening to flute music)at t = zero second.

H₁₆ : There is a significant difference in mean GSR value of control group (not exposed to listening to flute music) and experimental group (exposed to listening to flute music) at t =300 seconds.

H₁₇ : There is a significant difference in the mean GSR Value of control group (not exposed to listening to saxophone music) at t=zero second and at t=300 seconds.

H₁₈ : There is a significant difference in the mean GSR Value of experimental group (exposed to listening saxophone music) at t=zero second and at t=300 seconds.

H₁₉ : There is a significant difference in mean GSR value of control group (not exposed to listening to saxophone music) and experimental group (exposed to listening to saxophone music) at t = zero second.

H₂₀ : There is a significant difference in mean GSR value of control group (not exposed to listening to saxophone music) and experimental group (exposed to listening to saxophone music) at t =300 second.

The hypotheses H₇-H₈ , H₁₁-H₁₂ , H₁₅-H₁₆ and H₁₉-H₂₀ involve comparison between both the groups, the control and experimental. This is essential for gauging the effect of undergoing any drill to understand whether it is able to affect the mean GSR value.

3.3 Phases of Research

The entire research activity is segregated into four phases of research:

Phase 1 (Selection of Population and Size of Sample)

The engineering students as population were selected because they face stress due to Academic, Financial and Personal factors. The population in this study is finite and comprises of engineering students of Punjab which is approximately 12000 for four engineering streams selected. In general 5% of the population is taken as sample. As per sample size determining formula 95% confidence level, the sample size needed comes out to be 372. Accordingly the size taken for the sample is 400.

Initial study was conducted on 471 Engineering students (who volunteered), from four streams i.e. Civil, Computer, Electronics and Communication and Mechanical Engineering in the age group of 18 to 22 years. They were selected from two state universities of engineering (one private and other government as mentioned above). The details are shown through Table 3.3.1. These two universities are rated high in state and national rankings.

Phase 2 (Selection of the Sample)

The details of the 400 subjects selected are shown in table 3.3.2 and table 3.3.3. The students were short-listed based on their self observation reported, as well in the interview about exhibiting stress.

The group of 400 students were classified on basis of age {< 20 years (84), = 20 years (134) and >20 years (182)}, gender {males (296) and females (104)}, type of family {nuclear (300) and joint (100)} Religion {Hindu (291), Sikh (108) and others (1)}.

Phase 3 (Classification of Samples)

They were classified as control group (200 students as shown is Table 3.3.2) and experimental group (200 students as shown is Table 3.3.3).

Both the groups were formed from a similar population. The experimental group had revealed high willingness to undergo the drills of yogic breathing exercise and listening to Musical hymns, flute and saxophone and they wished to get their skin conductivity (GSR) level monitored through GSR sensor meter.

Phase 4 (Experimental Testing)

Testing Part with GSR and different stimuli

Table 3.3.1 : Details of the Subjects

Type of University	Trade	Total
Government University of Engineering	Civil Engineering	56
	Computer Engineering	60
	Electronics and Communication Engineering	54
	Mechanical Engineering	58
Private University of Engineering	Civil Engineering	56
	Computer Engineering	63
	Electronics and Communication Engineering	61
	Mechanical Engineering	63
	Total	471

Then final selection of 400 subjects is shown in Tables 3.3.2 and 3.3.3. The students were short-listed based on their self observation reported, as well in the interview about exhibiting stress.

Table 3.3.2 : Details of the Subjects for Control Group Studies

Type of University	Trade	Females	Males	Total
Government University of Engineering	Civil Engineering	3	22	25
	Computer Engineering	14	11	25
	Electronics and Communication Engineering	9	16	25
	Mechanical Engineering	1	24	25
Private University of Engineering	Civil Engineering	1	24	25
	Computer Engineering	11	14	25
	Electronics and Communication Engineering	13	12	25
	Mechanical Engineering	zero	25	25
		52	148	200

Table 3.3.3 : Details of the Subjects for Experimental Group Studies

Type of University	Trade	Females	Males	Total
Government University of Engineering	Civil Engineering	3	22	25
	Computer Engineering	14	11	25
	Electronics and Communication Engineering	9	16	25
	Mechanical Engineering	1	24	25
Private University of Engineering	Civil Engineering	1	24	25
	Computer Engineering	11	14	25
	Electronics and Communication Engineering	13	12	25
	Mechanical Engineering	zero	25	25
		52	148	200

3.4 Research Design and Research Methods

This section covers research design, sampling design, sources of data collection, details of questionnaire, validity and reliability and research methods used for data analysis in the study.

3.4.1 Survey instrument

The students were short-listed based on their self observation reported, as well in the interview about exhibiting stress. The group of 400 students were classified. The Stress level was assessed with the help of a self structured questionnaire. Questionnaire comprised of personal data form, which includes the basic information of the respondents such as age; stream; university; gender; religion; and type of family. There were 75 questions (Appendix I):. The bifurcation of the questions was Academic Stress (34); Financial Stress (7); Personal Stress (15); and Stress Relieving Strategies(19). Responose method was through Rating each factor on Likert's 5 point scale by ticking (√) on one of the five boxes where 1 meant least priority and 5 was highest priority.

3.4.2 Reliability and Validity

A pilot study was conducted for pre-testing of questionnaire on a group of 54 respondents for checking the reliability and validity of the questionnaire. Valuable suggestions of academicians and researchers were incorporated and some of questions were reframed for satisfying the research objectives. The details of the final questionnaire are provided in Appendix I. The questionnaire was validated by the academicians and researchers. It possesses a good validation score (3.7 on a scale of 5). The changes suggested by experts were incorporated in the questionnaire. Some questions were deleted and at same time, some were rephrased. Reliability applies to a measure when similar results are obtained over time and across situations. The details of reliability of different sections have been reported through table 3.4.1.

Table 3.4.1 : Reliability Statistics

S. No.	Items	Factor Name	Cronbach Alpha
1.	34	Academic Stress	0.913
2.	15	Personal Stress	0.791
3.	07	Financial Stress	0.794
4.	19	Stress Relieving Strategy	0.744
	75	Total	0.929

The questionnaire has an overall reliability score of 0.929. Hence the questionnaire was found to be valid and reliable to be used for further analysis.

Convergent Validity

Convergent validity is shown when each measured item correlates strongly with its assumed theoretical construct. For the convergent validity, the factor loadings and Average Variance Extracted (AVE) should be greater than 0.5 and composite reliability of 0.70. The formula for calculating AVE using the formula suggested by Hair *et al.*, (1995) as given below:

AVE = (sum of squared standardized loadings) / (sum of squared standardized loadings + sum of measurement error variances)

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \delta_i}$$

Where λ is the standardized factor loadings and δ is the indicator measurement error.

Discriminant Validity

Discriminant validity is the extent to which a construct is truly distinct from other constructs. Discriminant validity is considered when Square root of AVE greater than inter-construct correlations

The instrument demonstrates (Table 3.4.2) evidence of convergent validity through AVE (average variance extracted). The results also confirmed composite reliability of constructs as the value was more than 0.70 for personal, financial and academic stress. For Stress relieving strategies also it was quite close to 0.70. To measure the discriminant validity square root of AVE of each construct was undertaken. The instrument illustrated discriminant validity as square root of AVE estimate of each construct was larger than the correlations of this construct. Inter construct correlations were also low (Fornell and Larcker, 1981).

Table 3.4.2: Convergent and Discriminant validity

Correlations/ Discriminant and Convergent validity					Square Root of AVE	Composite Reliability
	PS	FS	AS	SRS		
PS: Personal Stress	1				0.710	0.701
FS: Financial Stress	.422 ^{**}	1			0.801	0.716
AS: Academic Stress	.671 ^{**}	.544 ^{**}	1		0.701	0.814
SRS: Stress relieving strategies	.411 ^{**}	.312 ^{**}	.348 ^{**}	1	0.677	0.686
^{**} Correlation is significant at the 0.01 level (2-tailed).						

3.4.3 Data collection procedures

The students (males as well as females) were opted from the four common streams of both Universities viz. i) Civil , ii) Computer, iii) Electronics & Communication, and iv) Mechanical Engineering. The Stress level was assessed with the help of a self structured questionnaire. There were two groups, Control and Experimental group having 200 students each. The Experimental group had 200 students, who were exposed to various stress management strategies as reported in earlier section.

3.4.4 Experimental Research

The study used Digital Electronic Instrument viz. GSR (Galvanic Skin Response) meter shown in Figure 3.1 for monitoring stress. GSR is a method of measuring the skin conductance of the skin, which varies with its moisture level. This is of interest because the sweat glands are controlled by the sympathetic nervous system, so skin conductance is used as an indication of psychological or physiological arousal. The GSR meter, is a biofeedback monitoring device designed to detect a person's mental state or change of state. The nervous system uses electrical impulses which are affected by the person's thoughts, emotions, physical condition etc. The GSR meter passes a tiny electrical carrier wave (approx. 0.5-3.0 volts) through the body, which picks up the fluctuations in

resistance caused by the person's overall general mood and emotional reactions to specific stimuli. These changes in conductance are known as the galvanic skin response.



Figure 3.1: GSR Meter

Different drills were applied for monitoring stress (through GSR meter, a digital electronics device) of 200 short-listed Engineering students.

The two sets of readings were recorded at $t = \text{zero second}$ and 300 seconds.

Four types of drills were used.

These include:

Testing Part with GSR and different stimuli

- i. Undergoing Yoga (Deep Breathing)
- ii. Undergoing Meditation (Listening to Musical Religious Hymns (like OM Chanting/Satnaam Vaheguru)
- iii. Listening to Indian Classical Instrumental Music (Flute)
- iv. Listening to Western Instrumental Music (Saxophone)

The control group was not exposed to any drill (Natural Condition).

In this experimentation, the researchers investigated the effects of various drills on physiological parameter GSR monitored through Digital Electronic Meter. After taking the permission from ethical committee for conducting this experimental study, the respondents were also requested to sign a consent form. As shown in table 3.3.2 and table 3.3.3, there were 400 engineering students (104 females and 296 males) aged 18-22 years. For experimental recordings, Galvanic Skin Response (GSR) Meter, manufactured by Psychometric Research, London (U.K.) (“GSR Biofeedback Monitor,” 2015) was used, which carried out Non Destructive Testing on the participants as shown for few in Appendix II.

The following steps were followed for Control and Experimental Group (table 3.3.2 and table 3.3.3):

- i. The subjects were made to sit on comfortable and relaxing chair. The hand portion was made fully moisture free.
- ii. The meter electrodes were attached to fore finger and first finger of their hand. The initial reading of the GSR (micro Siemens) was recorded using GSR meter at $t=$ zero second.
- iii. Experimental subject was subjected to various drills (one by one on different days) for 300 seconds. Meanwhile, the meter was kept attached to the participant for 300 seconds. The control group was not exposed to any drill. The reading of the GSR was recorded again at $t = 300$ seconds.

The same process was repeated for all students. The instructions for the use of meter were followed as given in its manual (“GSR Biofeedback Monitor,” 2015). The entire process was repeated for all subjects. The time taken for exposure to drills and recordings was as per the consent of the respondents.

3.4.5 Research Methods

Data has been analyzed with the help of SPSS (Statistical Package for Social Sciences) package version 20 and Stata /IC13. Completed questionnaires were checked and coded before the raw data was entered for analysis. Several statistical techniques were applied

to test and interpret the results of the data analysis. These include: t test, ANOVA, Factor analysis to test hypotheses of the study which are briefly explained below:

3.4.5.1 Descriptive Statistics

Descriptive statistics provide summaries about the sample and about the observations that have been made. T-test has been applied and depicted through tables in next chapter for the different stimuli (pre and post) for control as well as experimental groups.

3.4.5.2 The Analysis of Variance (ANOVA)

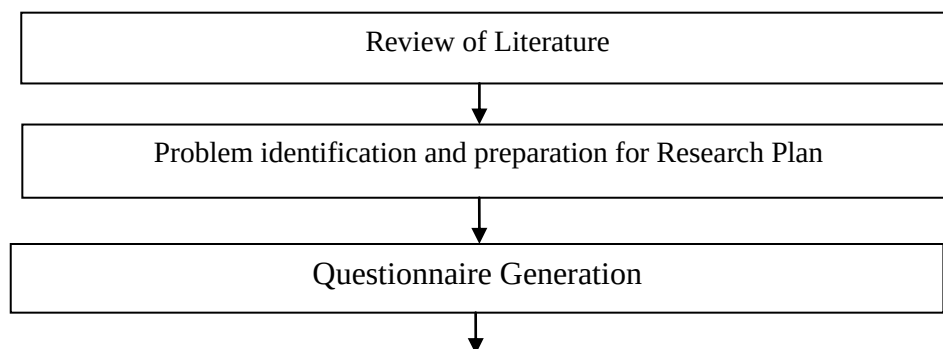
Analysis of variance (ANOVA) is a technique for studying cause and effect of one or more factors (independent variables) on a single dependent variable. In the present study, ANOVA has also been so applied to determine whether there is significant difference on the Academic Stress, Personal Stress, Finance Stress and Stress Relieving Strategies with respect to other demographic variables viz. gender, age, engineering streams and nature of university. Post-hoc Tukey has been used studying for intergroup variations.

3.4.5.3 Factor Analysis

Factor analysis attempts to identify a set of dimensions that is not directly observable in a large set of variables. This analysis is used to summarize most the information in a data set in terms of relatively lesser new categories, called factors (Cooper and Schindler, 2003). Factor analysis in the present study has been used for reducing the number of variables of Academic Stress, Personal Stress, Finance Stress and Stress Relieving Strategies into smaller number of factors.

3.5 Experimental Research Framework

Flow Chart of this research process for experimental group is as described in Figure 3.2



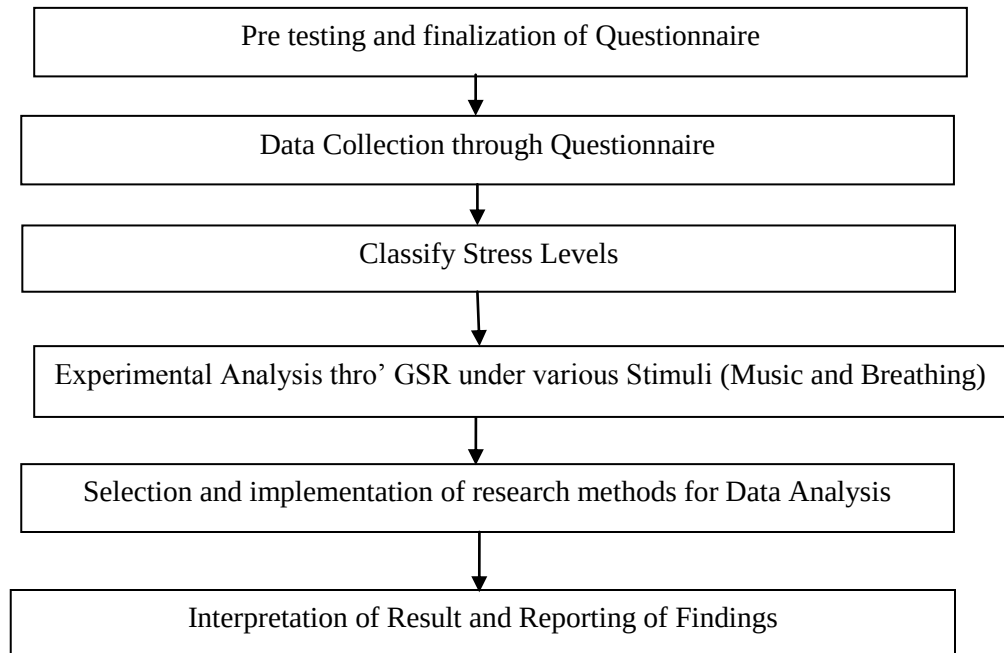


Figure 3.2 Research Framework (flow chart)

3.6 Conceptual Research Model

Flow diagram of this process for experimental group is as described in Figure 3.3.

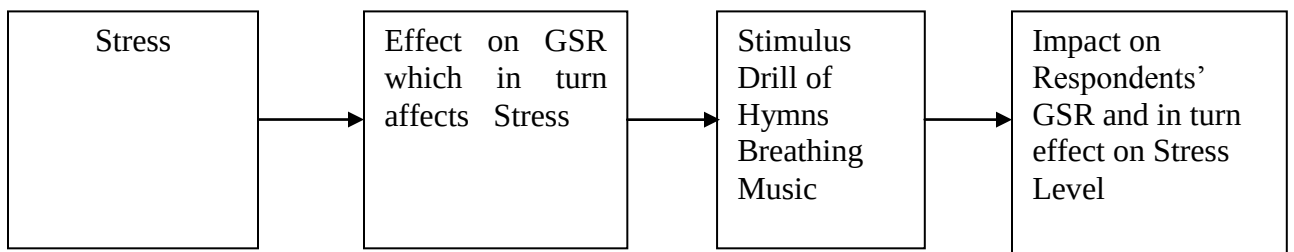


Figure 3.3 Flow Diagram of research process for Experimental Group

3.7 Concluding Remarks

Selection of a suitable research design and methodology is one of the most significant aspect that surface the means for targeted outcomes in the complete research process. This chapter has elaborated the details of step by step approach employed for carrying out the research activity. This chapter has presented a summary of methodology used for analyses of primary data collection. Methodology applied at different phases of this study has been explained. Finally, a brief overview of research methods used to test the hypotheses like ANOVA, Factor analysis has also been specified.

CHAPTER-4

DATA ANALYSIS AND INTERPRETATION

This chapter deals with analysis and discussions of the responses gathered from the respondents by conducting the survey of engineering students (who volunteered), from various four engineering streams i.e. Civil, Computer, Electronics and Communication and Mechanical Engineering in the age group of 18 to 22 years. They were selected from two state universities of engineering (one private and other government). The study investigates the effects of age, gender, engineering streams and nature of university grouping of respondents on academic stress, personal stress, financial stress and Stress Relieving Strategies of respondents. The study covers the effect on the GSR value of respondents through Yogic Breathing, Musical Religious Hymns, Flute Music and Saxophone Music. Section 4.1 covers the Demographic Profile of respondents i.e. Age, Gender, Engineering Streams and Nature of University. Section 4.2 covers Factors influencing Stress i.e. Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies of respondents. It is essential to compare the perception of sample population regarding Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies. This section tries to analyze the effect of Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies of respondents based on the demographic profile of respondents, viz. Gender, Age, Engineering Streams and Nature of University. Section 4.3 deals with Identification of High Stress Level through GSR Meter Section 4.4 covers Monitoring Stress Level under stimuli of Yogic Breathing, Musical Religious Hymns, Flute Music and Saxophone Music. Finally Section 4.5 covers the Identification of most effective Stimuli for Stress Management and Section 4.6 contains summing up.

4.1 Demographic Profile of respondents

Demographic characteristics of respondents undertaken in the present study are gender, age, engineering streams and nature of university wise distribution of respondents. Table 4.1.1 represents the demographic characteristics of the respondents which are shown below:

Table 4.1.1 : Demographic characteristics of respondents

Demographic characteristics	Classification	No.	Percentage %
Age	< 20 years	84	21
	= 20 years	134	33.5
	> 20 years	182	45.5
Gender	Male	296	74
	Female	104	26
Engineering Stream	Civil Engineering	50+ 50	25
	Computer Engineering	50+ 50	25
	Electronics and Communication Engineering	50+ 50	25
	Mechanical Engineering	50+ 50	25
Nature of University	Thapar University (Private)	200	50
	Punjabi University (Government)	200	50

The demographic characteristics undertaken in the present study are explained separately as below:

4.1.1 Age Group of Respondents

The age groups of respondents undertaken in the study are: < 20, = 20 and > 20. As depicted through Figure 4.1, respondents falling in the age group of < 20 years are 21 %. In the age group of = 20 years, 33.5 % of respondents were there and 45.5% respondents are over 20 years.

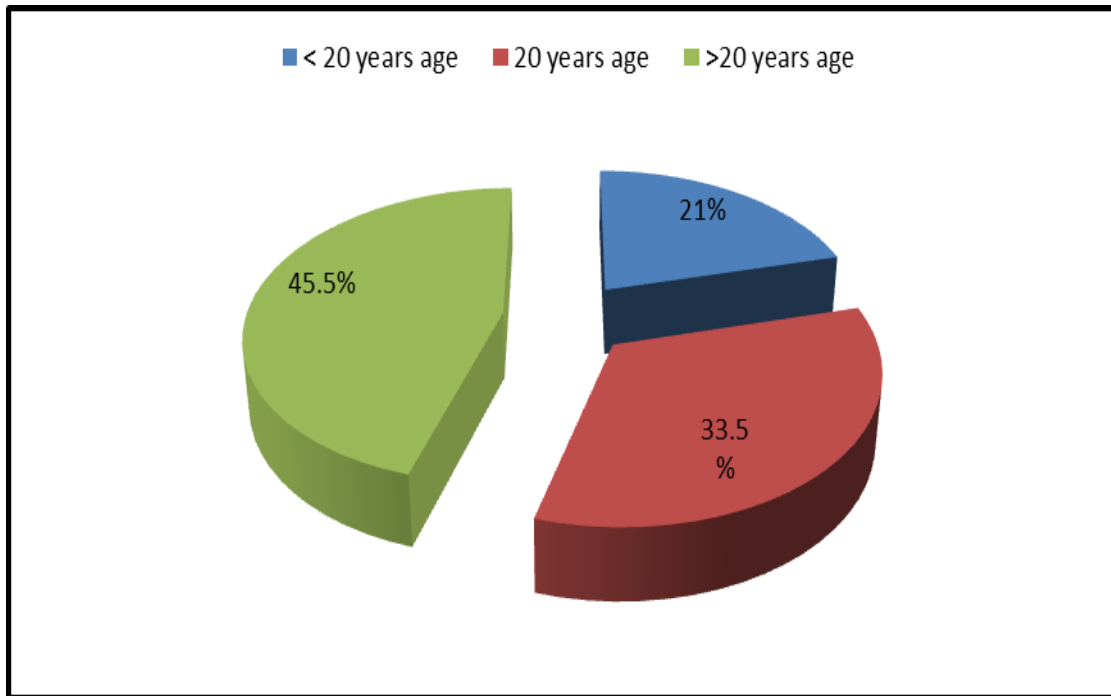


Figure 4.1: Age Group of Respondents

4.1.2 Gender of Respondents

The sample was dominated by males. Gender-wise analysis as shown in Figure 4.2 indicates that 74 percent respondents are males and 26 percent are females.

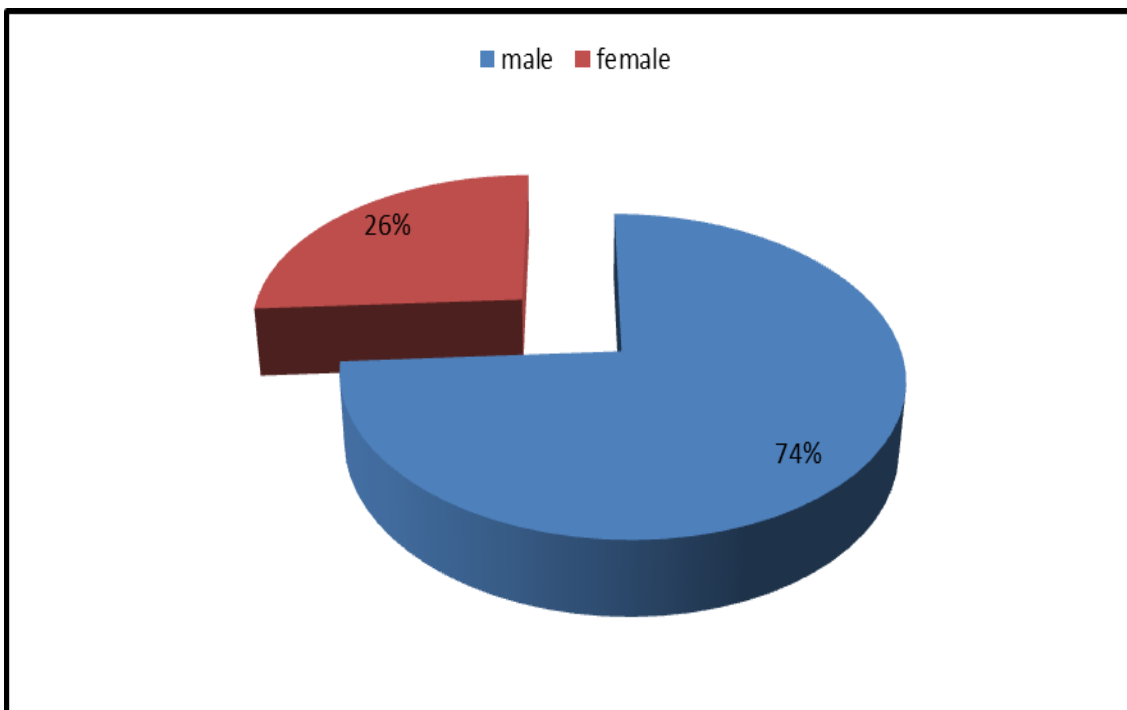


Figure 4.2: Gender of Respondents

4.1.3 Engineering Streams of Respondents

Four levels of Engineering Streams chosen for the survey are:

Civil Engineering, Computer Engineering, Electronics and Communication Engineering, Mechanical Engineering. Figure 4.3 indicates that respondents are equal from each all Engineering Streams i.e. 100 each.

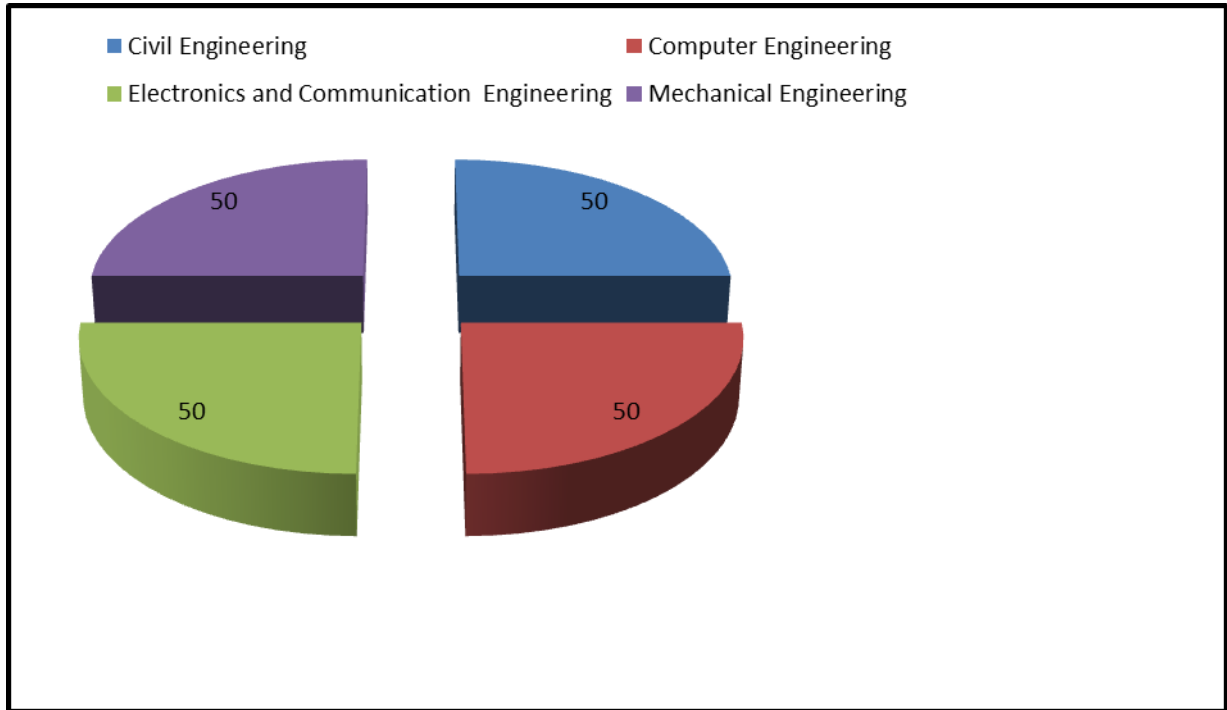


Figure 4.3: Engineering Streams of Respondents

4.1.4 Universities of Respondents

The respondents are from Thapar University (Private) and Punjabi University (Government) were equal i.e. 200 each as shown in Figure 4.4.

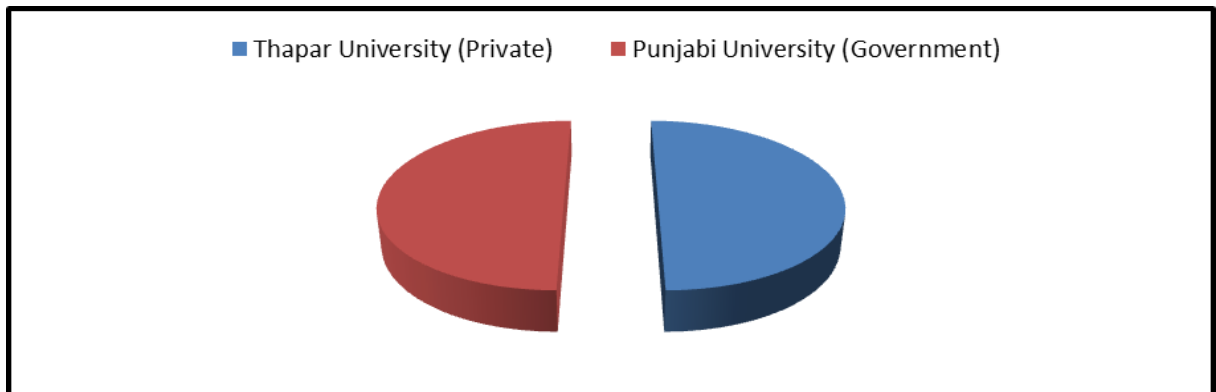


Figure 4.4: University Grouping of Respondents

4.2: Factors influencing Stress

The first objective of the research was:

O1: To identify the factors leading to Stress in Engineering Students of a Government University (Punjabi University, Patiala) and Private University (Thapar University, Patiala).

The achievement of this is explained in the sections 4.2.1 to 4.2.4.

4.2.1 Academic Stress

Effort was made to compare academic stress based on gender, age, engineering streams, nature of university. Accordingly, the following hypotheses have been framed:

H₁: There is a significant difference in the academic stress based on gender, age, engineering streams and nature of university.

H_{1a}: There is a significant difference in the academic stress based on gender.

H_{1b}: There is a significant difference in the academic stress based on age.

H_{1c}: There is a significant difference in the academic stress based on engineering streams.

H_{1d}: There is a significant difference in the academic stress based on nature of University.

ANOVA has been used to test the hypotheses and for intergroup comparisons Post hoc Tukey has been used.

Table 4.2.1.1 Factor analysis for identification of factors affecting Academic Stress

Factor Name	Items	Factor Loading	Eigen Value	% of Variance	C	AVE	CR
AS-1: Examination Stressors	AS19: Concern about results after examinations	.752	9.881	9.881	9.881	.501	.845
	AS17: Examination syllabus is too heavy in some subjects	.723					
	AS16: Exam papers are tough	.717					
	AS20: Tendency to 'day-dream' when trying to study	.712					
	AS21: Study periods are often too short for me to get 'warmed up' and concentrated	.620					
	AS18: Worrying about the examinations	.608					
AS-2: Inadequate Teaching Interaction	AS10: Lack of opportunity to meet teachers	.683	8.839	8.839	18.721	.529	.769
	AS11: Slow in getting along with the curriculum	.673					
	AS7: Inadequate query handling by teacher	.667					
	AS14: Lack of case studies to support teaching and learning	.500					
	AS31: Less placement opportunity provided by the institute	.500					
AS-3: Lack of Outreach opportunities	AS29: Inadequate lab space	.724	8.751	8.751	27.471	.546	.774
	AS27: Not able to grasp the subject matter	.673					
	AS34: Unfavorable Location of placement	.654					
	AS26: Unable to discuss Academic failures with parents	.603					

AS-4: Inadequate Learning Orientation	AS2: Lack of concentration during study hours	.698	7.616	7.616	35.087	.514	.730
	AS3: Difficulty in memorizing and retention of lectures	.672					
	AS1: Lack of interest in some subjects	.588					
	AS9: Lack of confidence in the class	.536					
AS-5: Lack of Interest	AS24: Enjoyment of loafing (spending time ideally), 'bull- seasons' (amusing and illogical use of words) interferes with my study	.773	6.812	6.812	41.899	.501	.716
	AS23: Too tired, sleepy and restless to study efficiently	.693					
	AS25: Dislike of certain courses and teachers interferes with getting good results	.552					
AS-6 : Problems of Interaction	AS22: Missing important points while taking notes in class	.622	4.878	4.878	46.777	.403	.508
	AS15: Lack of interactive sessions in class	.546					
AS-7: Poor Time Management	i. AS12: Unable to complete the assignment in time	.703	4.349	4.349	51.126	.405	.562
	ii. AS6: Personal hesitation to ask questions in class	.544					

C: Cumulative Variance; AVE: Average variance extracted; CR: Composite Reliability

The results of factor analysis as shown through Table 4.2.1.1 which highlights that based on factor analysis seven factors emerged. These seven factors explained 51.126 % of variation. The first factor viz. **AS-1** Examination Stressors had Eigen Value 9.881 and explained 9.881 % of variation. The first two items, viz. i.) AS19: Concern about results after examinations and ii.) AS17: Examination syllabus is too heavy in some subjects loaded heavily on first factor signifying higher importance than other factors. The

composite reliability is 0.845 and Average variance extracted is 0.501. This suggests high construct reliability for this factor.

The Second factor **AS-2** Inadequate Teaching Interaction explained 8.839 % of variation. i.) AS10: Lack of opportunity to meet teachers and ii.) AS11: Slow in getting along with the curriculum loaded high on this factor. Average variance extracted is 0.529 and composite reliability is 0.769, well above acceptable range.

The next factor viz. **AS-3** Lack of Outreach opportunities explained 8.751 % of Variation. The first two items, viz. i.) AS29: Inadequate lab space and ii.) AS27: Not able to grasp the subject matter loaded high on this factor. The Composite reliability is 0.774 and Average variance extracted is 0.546.

The fourth factor is **AS-4** Inadequate Learning Orientation. It had four items and item i) AS2: Lack of concentration during study hours and Item ii) AS3: Difficulty in memorizing and retention of lectures are important. The composite reliability is 0.730 and average variance extracted is 0.514 are both in acceptable range.

The fifth factor is **AS-5** Lack of Interest. It has three items. The First item viz. i.) AS24: Enjoyment of loafing (spending time ideally), 'bull- seasons' (amusing and illogical use of words) interferes with my study had highest loading of 0.773 followed by ii.) AS23: Too tired, sleepy and restless to study efficiently with loading of 0.693. This factor explains 6.812 % of Variance. The average variance extracted is 0.501 and Composite reliability is 0.716.

AS-6 Problems of Interaction had two items only viz. i.) AS22: Missing important points while taking notes in class with item loading of 0.622; and ii.) AS15: Lack of interactive sessions in class. The average variance extracted is 0.403 and Composite reliability is .508. The values are comparatively low, but are important and hence included for further examination.

AS-7 Poor Time Management had also two items with i.) AS12: Unable to complete the assignment in time having loading of 0.703 and ii.) AS6: Personal hesitation to ask questions in class having a lower loading of 0.544. The average variance extracted is .405 and Composite reliability is 0.562. The values are comparatively low, but are important for further examination, hence retained.

Table 4.2.1.2: ANOVA results factors influencing Academic Stress based on Gender

		Sum of Squares	df	Mean Square	F	Sig.
AS-1 Examination Stressors	Between Groups	.213	1	.213	.280	.597
	Within Groups	302.598	398	.760		
	Total	302.811	399			
AS-2 Inadequate Teaching Interaction	Between Groups	.220	1	.220	.343	.558
	Within Groups	255.311	398	.641		
	Total	255.531	399			
AS-3 Lack of Outreach opportunities	Between Groups	.811	1	.811	1.127	.289
	Within Groups	286.298	398	.719		
	Total	287.109	399			
AS-4 Inadequate Learning Orientation	Between Groups	2.988	1	2.988	4.183	0.041*
	Within Groups	284.343	398	.714		
	Total	287.331	399			
AS-5 Lack of Interest	Between Groups	.014	1	.014	.020	.887
	Within Groups	284.891	398	.716		
	Total	284.905	399			
AS-6 Problems of Interaction	Between Groups	.406	1	.406	.459	.499
	Within Groups	352.188	398	.885		
	Total	352.594	399			
AS-7 Poor Time Management	Between Groups	.152	1	.152	.147	.702
	Within Groups	411.626	398	1.034		
	Total	411.777	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results (table 4.2.1.2) reflect that there is a significant difference in perception of respondents in only one of the seven factors influencing academic stress based on gender groups (male and female) considered for analysis. This is: AS-4 : Inadequate Learning Orientation but for other six factors i.e. AS-1 : Examination Stressors, AS-2 : Inadequate Teaching Interaction, AS-3 : Lack of Outreach opportunities, AS-5 : Lack of Interest, AS-6 : Problems of Interaction, AS-7 : Poor Time Management, the results didn't reflect significant difference on academic stress with respect to gender grouping. This shows there is similarity of perception of the respondents on the academic stress based on gender grouping.

Thus, the hypothesis H_{1a} : there is a significant difference in the academic stress with respect to the different gender groups has been rejected.

Table 4.2.1.3 : ANOVA results factors influencing Academic Stress based on Age

		Sum of Squares	df	Mean Square	F	Sig.
AS-1 Examination Stressors	Between Groups	10.949	2	5.475	7.447	.001**
	Within Groups	291.861	397	.735		
	Total	302.811	399			
AS-2 Inadequate Teaching Interaction	Between Groups	.991	2	.496	.773	.462
	Within Groups	254.540	397	.641		
	Total	255.531	399			
AS-3 Lack of Outreach opportunities	Between Groups	2.210	2	1.105	1.540	.216
	Within Groups	284.899	397	.718		
	Total	287.109	399			
AS-4 Inadequate Learning Orientation	Between Groups	2.265	2	1.132	1.577	.208
	Within Groups	285.066	397	.718		
	Total	287.331	399			
AS-5 Lack of Interest	Between Groups	.646	2	.323	.451	.637
	Within Groups	284.259	397	.716		
	Total	284.905	399			
AS-6 Problems of Interaction	Between Groups	1.377	2	.688	.778	.460
	Within Groups	351.218	397	.885		
	Total	352.594	399			
AS-7 Poor Time Management	Between Groups	.367	2	.184	.177	.838
	Within Groups	411.410	397	1.036		
	Total	411.778	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results shown through table 4.2.1.3 reflect that there is a significant difference in only one of the seven factors influencing academic stress based on age groups considered for analysis. This is: AS-1: Examination Stressors, but for AS-2 : Inadequate Teaching Interaction, AS-3 : Lack of Outreach opportunities, AS-4 : Inadequate Learning Orientation, AS-5 : Lack of Interest, AS-6 : Problems of Interaction and AS-7 : Poor Time Management, the results didn't reflect significant difference on academic stress with respect to age grouping. This shows there is similarity of perception of the respondents on the academic stress based on age grouping.

Table 4.2.1.4 : Tukey HSD Results for academic stress factors and different age groups

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
AS-1: Examination Stressors	<20	=20	.463*	.120	0.000***	.18	.75
		>20	.299*	.114	0.024*	.03	.57
	=20	<20	-.463*	.120	0.000***	-.75	-.18
		>20	-.164	.097	.212	-.39	.06
	>20	<20	-.299*	.114	0.024*	-.57	-.03
		=20	.164	.097	.212	-.06	.39
AS-2: Inadequate Teaching Interaction	<20	=20	-.058	.112	.863	-.32	.21
		>20	.055	.106	.864	-.20	.31
	=20	<20	.058	.112	.863	-.21	.32
		>20	.113	.091	.429	-.10	.33
	>20	<20	-.055	.106	.864	-.31	.20
		=20	-.113	.091	.429	-.33	.10
AS-3: Lack of Outreach opportunities	<20	=20	.167	.119	.337	-.11	.45
		>20	.193	.113	.201	-.07	.46
	=20	<20	-.167	.119	.337	-.45	.11
		>20	.026	.096	.961	-.20	.25
	>20	<20	-.193	.113	.201	-.46	.07
		=20	-.026	.096	.961	-.25	.20
AS-4: Inadequate Learning Orientation	<20	=20	.200	.119	.211	-.08	.48
		>20	.078	.113	.767	-.19	.34
	=20	<20	-.200	.119	.211	-.48	.08
		>20	-.122	.096	.412	-.35	.10
	>20	<20	-.078	.113	.767	-.34	.19
		=20	.122	.096	.412	-.10	.35
AS-5: Lack of Interest	<20	=20	.057	.118	.881	-.22	.34
		>20	-.034	.112	.950	-.30	.23
	=20	<20	-.057	.118	.881	-.34	.22
		>20	-.091	.096	.609	-.32	.13
	>20	<20	.034	.112	.950	-.23	.30
		=20	.091	.096	.609	-.13	.32
AS-6: Problems of Interaction	<20	=20	.057	.132	.903	-.25	.37
		>20	.146	.125	.474	-.15	.44
	=20	<20	-.057	.132	.903	-.37	.25
		>20	.089	.107	.681	-.16	.34
	>20	<20	-.146	.125	.474	-.44	.15
		=20	-.089	.107	.681	-.34	.16
AS-7: Poor Time Management	<20	=20	.032	.143	.973	-.30	.37
		>20	.076	.135	.840	-.24	.39
	=20	<20	-.032	.143	.973	-.37	.30
		>20	.044	.115	.922	-.23	.32
	>20	<20	-.076	.135	.840	-.39	.24
		=20	-.044	.115	.922	-.32	.23

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.1.4. In case of AS-1 : Examination Stressors , there was a significant difference between all 3 age groups i.e. < 20 and =20 age group and >20 and <20 age group.

Thus, the hypothesis H_{1b} : there is a significant difference in the academic stress with respect to the different age groups has been rejected.

Table 4.2.1.5 ANOVA results for factors influencing Academic Stress based on Engineering Streams

		Sum of Squares	df	Mean Square	F	Sig.
AS-1: Examination Stressors	Between Groups	19.869	3	6.623	9.269	0.000***
	Within Groups	282.942	396	.714		
	Total	302.811	399			
AS-2: Inadequate Teaching Interaction	Between Groups	8.069	3	2.690	4.304	0.005**
	Within Groups	247.462	396	.625		
	Total	255.531	399			
AS-3: Lack of Outreach opportunities	Between Groups	2.321	3	.774	1.076	.359
	Within Groups	284.789	396	.719		
	Total	287.109	399			
AS-4: Inadequate Learning Orientation	Between Groups	11.198	3	3.733	5.353	0.001**
	Within Groups	276.133	396	.697		
	Total	287.331	399			
AS-5: Lack of Interest	Between Groups	3.410	3	1.137	1.599	.189
	Within Groups	281.495	396	.711		
	Total	284.905	399			
AS-6: Problems of Interaction	Between Groups	9.157	3	3.052	3.519	0.015*
	Within Groups	343.438	396	.867		
	Total	352.594	399			
AS-7: Poor Time Management	Between Groups	6.927	3	2.309	2.259	.081
	Within Groups	404.850	396	1.022		
	Total	411.778	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results in Table 4.2.1.5 reflect that there is a significant difference in perception of respondents in four of the seven factors influencing academic stress based on Engineering Streams considered for analysis. This is: AS-1 : Examination Stressors, AS-2 : Inadequate Teaching Interaction, AS-4 : Inadequate Learning Orientation, AS-6 : Problems of Interaction but for other three factors i.e. AS-3 : Lack of Outreach

opportunities, AS-5 : Lack of Interest and AS-7 : Poor Time Management, the results didn't reflect significant difference on academic stress with respect to engineering stream grouping. This shows for these three factors AS-3 : Lack of Outreach opportunities, AS-5 : Lack of Interest and AS-7 : Poor Time Management, there is similarity of perception of the respondents on the academic stress based on engineering streams grouping.

Table 4.2.1.6 : Tukey HSD Results for academic stress factors and different engineering streams groups

Dependent Variable	(I) Stream	(J) Stream	Mean Difference (I-J)	Std. Error		95% Confidence Interval	
						Lower Bound	Upper Bound
AS-1: Examination Stressors	Civil	Computer	-.343*	.120	0.022*	-.65	-.03
		Electronics and Communication	-.629*	.120	0.000***	-.94	
		Mechanical	-.338*	.120	0.025*	-.65	-.03
	Computer	Civil	.343*	.120	0.022*	.03	.65
		Electronics and Communication	-.286	.120	.080	-.59	.02
		Mechanical	.005	.120	1.000	-.30	.31
	Electronics and Communication	Civil	.629*	.120	0.000***	.32	.94
		Computer	.286	.120	.080	-.02	.59
		Mechanical	.291	.120	.072	-.02	.60
	Mechanical	Civil	.338*	.120	0.025*	.03	.65
		Computer	-.005	.120	1.000	-.31	.30
		Electronics and Communication	-.291	.120	.072	-.60	.02
AS-2: Inadequate Teaching Interaction	Civil	Computer	-.010	.112	1.000	-.30	.28
		Electronics and Communication	-.336*	.112	0.015*	-.62	-.05
		Mechanical	-.216	.112	.216	-.50	.07
	Computer	Civil	.010	.112	1.000	-.28	.30
		Electronics and Communication	-.326*	.112	0.020*	-.61	-.04
		Mechanical	-.206	.112	.255	-.49	.08
	Electronics and Communication	Civil	.336*	.112	0.015*	.05	.62
		Computer	.326*	.112	0.020*	.04	.61
		Mechanical	.120	.112	.706	-.17	.41
	Mechanical	Civil	.216	.112	.216	-.07	.50
		Computer	.206	.112	.255	-.08	.49
		Electronics and Communication	-.120	.112	.706	-.41	.17
	Civil	Computer	-.092	.120	.867	-.40	.22

AS-3: Lack of Outreach opportunities		Electronics and Communication	-.163	.120	.528	-.47	.15
		Mechanical	-.200	.120	.342	-.51	.11
	Computer	Civil	.092	.120	.867	-.22	.40
		Electronics and Communication	-.070	.120	.937	-.38	.24
		Mechanical	-.107	.120	.807	-.42	.20
	Electronics and Communication	Civil	.163	.120	.528	-.15	.47
		Computer	.070	.120	.937	-.24	.38
		Mechanical	-.037	.120	.989	-.35	.27
	Mechanical	Civil	.200	.120	.342	-.11	.51
		Computer	.107	.120	.807	-.20	.42
		Electronics and Communication	.037	.120	.989	-.27	.35
AS-4: Inadequate Learning Orientation	Civil	Computer	-.270	.118	.103	-.57	.03
		Electronics and Communication	-.375*	.118	0.009**	-.68	-.07
		Mechanical	.007	.118	1.000	-.30	.31
	Computer	Civil	.270	.118	.103	-.03	.57
		Electronics and Communication	-.105	.118	.811	-.41	.20
		Mechanical	.277	.118	.089	-.03	.58
	Electronics and Communication	Civil	.375*	.118	.009	.07	.68
		Computer	.105	.118	.811	-.20	.41
		Mechanical	.382*	.118	.007	.08	.69
	Mechanical	Civil	-.007	.118	1.000	-.31	.30
		Computer	-.277	.118	.089	-.58	.03
Electronics and Communication		-.382*	.118	.007	-.69	-.08	
AS-5: Lack of Interest	Civil	Computer	-.050	.119	.976	-.36	.26
		Electronics and Communication	-.163	.119	.522	-.47	.14
		Mechanical	.093	.119	.862	-.21	.40
	Computer	Civil	.050	.119	.976	-.26	.36
		Electronics and Communication	-.113	.119	.779	-.42	.19
		Mechanical	.143	.119	.628	-.16	.45
	Electronics and Communication	Civil	.163	.119	.522	-.14	.47
		Computer	.113	.119	.779	-.19	.42
		Mechanical	.256	.119	.140	-.05	.56
	Mechanical	Civil	-.093	.119	.862	-.40	.21
		Computer	-.143	.119	.628	-.45	.16
Electronics and Communication		-.256	.119	.140	-.56	.05	
AS-6: Problems of Interaction	Civil	Computer	-.380*	.132	0.021*	-.72	-.04
		Electronics and Communication	-.330	.132	.061	-.67	.01
		Mechanical	-.145	.132	.689	-.48	.19
	Computer	Civil	.380*	.132	0.021*	.04	.72
		Electronics and Communication	.050	.132	.981	-.29	.39

	Electronics and Communication	Mechanical	.235	.132	.282	-.10	.57
		Civil	.330	.132	.061	-.01	.67
		Computer	-.050	.132	.981	-.39	.29
		Mechanical	.185	.132	.497	-.15	.52
	Mechanical	Civil	.145	.132	.689	-.19	.48
		Computer	-.235	.132	.282	-.57	.10
		Electronics and Communication	-.185	.132	.497	-.52	.15
		Computer	-.050	.143	.985	-.42	.32
	Civil	Electronics and Communication	-.340	.143	.083	-.71	.03
		Mechanical	-.180	.143	.590	-.55	.19
AS-7: Poor Time Management	Computer	Civil	.050	.143	.985	-.32	.42
		Electronics and Communication	-.290	.143	.179	-.66	.08
		Mechanical	-.130	.143	.800	-.50	.24
	Electronics and Communication	Civil	.340	.143	.083	-.03	.71
		Computer	.290	.143	.179	-.08	.66
		Mechanical	.160	.143	.678	-.21	.53
	Mechanical	Civil	.180	.143	.590	-.19	.55
		Computer	.130	.143	.800	-.24	.50
		Electronics and Communication	-.160	.143	.678	-.53	.21

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.1.6. In case of AS-1: Examination Stressors, significant difference was found between Civil and Computer, Civil and Electronics and Communication, Civil and Mechanical. In AS-2 : Inadequate Teaching Interaction, the difference was significant between Civil and Electronics and Communication , Computer and Electronics and Communication In AS-4 : Inadequate Learning Orientation, there was a significant difference between Civil and Electronics and Communication, Mechanical and Electronics and Communication. In AS-6 : Problems of Interaction , significant difference was found between Civil and Computer.

Thus, the hypothesis H_{1c} : there is a significant difference in the academic stress with respect to the different engineering stream groups has been partially accepted.

Table 4.2.1.7 : ANOVA results for factors influencing Academic Stress based on Nature of University

		Sum of Squares	df	Mean Square	F	Sig.
AS-1: Examination Stressors	Between Groups	.060	1	.060	.079	.778
	Within Groups	302.751	398	.761		
	Total	302.811	399			
AS-2: Inadequate Teaching Interaction	Between Groups	3.648	1	3.648	5.764	0.017*
	Within Groups	251.883	398	.633		
	Total	255.531	399			
AS-3: Lack of Outreach opportunities	Between Groups	4.306	1	4.306	6.059	0.014*
	Within Groups	282.804	398	.711		
	Total	287.109	399			
AS-4: Inadequate Learning Orientation	Between Groups	2.139	1	2.139	2.985	.085
	Within Groups	285.192	398	.717		
	Total	287.331	399			
AS-5: Lack of Interest	Between Groups	3.608	1	3.608	5.105	0.024*
	Within Groups	281.297	398	.707		
	Total	284.905	399			
AS-6: Problems of Interaction	Between Groups	.856	1	.856	.968	.326
	Within Groups	351.739	398	.884		
	Total	352.594	399			
AS-7: Poor Time Management	Between Groups	1.323	1	1.323	1.282	.258
	Within Groups	410.455	398	1.031		
	Total	411.778	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results (table 4.2.1.7) reflect that there is a significant difference in perception of respondents in three of the seven factors influencing academic stress based on university groups considered for analysis. This is: AS-2 : Inadequate Teaching Interaction, AS-3 : Lack of Outreach opportunities and AS-5 : Lack of Interest but for other four factors i.e. AS-1 : Examination Stressors, AS-4 : Inadequate Learning Orientation, AS-6 : Problems of Interaction and AS-7 : Poor Time Management, the results didn't reflect significant difference on academic stress with respect to university grouping. This shows there is similarity of perception of the respondents on the academic stress based on university grouping.

Thus, the hypothesis H_{1d}: there is a significant difference in the academic stress with respect to the different university groups have been partially accepted.

4.2.2 Personal Stress

To compare personal stress based on gender, age, engineering streams and nature of university the following hypotheses have been framed:

H₂: There is a significant difference in the personal stress based on gender, age, engineering streams and nature of university.

H_{2a}: There is a significant difference in the personal stress based on gender.

H_{2b}: There is a significant difference in personal stress based on age.

H_{2c}: There is a significant difference in the personal stress based on engineering streams.

H_{2d}: There is a significant difference in the personal stress based on nature of University.

ANOVA has been used to test the hypotheses and for intergroup comparisons Post hoc Tukey has been used.

Table 4.2.2.1 Factor analysis for identification of factors affecting Personal Stress

Factor Name	Items	Factor Loading	Eigen Value	% of Variance	C	AVE	CR
PS-1: Poor Organising & Management Skills	PS6: Getting excited very easily	.796	16.919	16.919	16.919	.534	.820
	PS7: Unable to take strong decisions	.769					
	PS4: Time is unwisely distributed; spending too much time on something leaving inadequate time for other tasks	.687					
	PS5: Over learning and working beyond the point of immediate memory or recall	.662					
PS-2: Intricacies of Communication	PS2: Lack of fluency while speaking the language other than the mother tongue	.761	16.431	16.431	33.351	.494	.721
	PS3: Difficulty in public speaking	.715					
	PS1: Lack of	.698					

	Self confidence						
	PS13: Unduly imaginary calamities	.564					
PS-3: Callous Attitude	PS9: Difficulty in adjusting with opposite gender	.714	11.747	11.747	45.098	.430	.700
	PS12: I feel that this world is a place good enough for passing life	.692					
	PS10: Unnecessarily worrying about my responsibilities	.574					
PS-4: Perplexed Behavior	PS14: Too perplexed (puzzled or confused) with my contradictory thoughts	.853	10.645	10.645	55.743	.555	.709
	PS15: Too anxious about my future	.619					

C: Cumulative; AVE: Average variance extracted; CR: Composite Reliability

The results of factor analysis as shown through Table 4.2.2.1, highlight that based on factor analysis seven factors emerged. These four factors explained 55.743 % of variation. The first factor viz. **PS-1** Poor Organising & Management Skills had Eigen Value 16.919 and explained 16.919 % of variation. The first two items, viz. PS6: Getting excited very easily PS7: Unable to take strong decisions loaded heavily (0.796 and 0.769 respectively) on first factor signifying higher importance than other factors. The composite reliability is .820 and Average variance extracted is .534. This suggests high construct reliability for this factor.

The Second factor **PS-2** Intricacies of Communication explained 16.431 % of variation. The first two items, viz. PS2: Lack of fluency while speaking the language other than the mother tongue and PS3: Difficulty in public speaking loaded high (0.761 and 0.715 respectively) on this factor.

Average variance extracted is .494 and composite reliability is .721, well above acceptable range. The next factor viz. **PS-3** Callous Attitude explained 11.747 % of Variation. The first two items, viz. PS9: Difficulty in adjusting with opposite gender PS12: I feel that this world is a place good enough for passing life loaded high (as 0.714 and 0.692 respectively) on this factor. The Composite reliability is 0.700 and Average variance extracted is 0.430. The fourth factor is **PS-4** Perplexed Behavior. It had two

important items (loaded as 0.853 and 0.619), PS14: Too perplexed (puzzled or confused) with my contradictory thoughts and PS15: Too anxious about my future. The composite reliability is 0.709 and average variance extracted is 0.555 are both in acceptable range.

Table 4.2.2.2 : ANOVA results for factors influencing Personal Stress based on Gender

		Sum of Squares	df	Mean Square	F	Sig.
PS-1: Poor Organising & Management Skills	Between Groups	.282	1	.282	.453	.501
	Within Groups	247.687	398	.622		
	Total	247.969	399			
PS-2: Intricacies of Communication	Between Groups	.005	1	.005	.007	.935
	Within Groups	290.443	398	.730		
	Total	290.447	399			
PS-3: Callous Attitude	Between Groups	.132	1	.132	.188	.665
	Within Groups	278.569	398	.700		
	Total	278.701	399			
PS-4: Perplexed Behavior	Between Groups	14.530	1	14.530	13.525	0.000***
	Within Groups	427.567	398	1.074		
	Total	442.098	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results reflect that there is significant difference in perception of respondents in only one of the four factors influencing personal stress based on gender groups considered for analysis. The results are shown through Table 4.2.2.2. This is: PS-4: Perplexed Behavior where as other three factors PS-1: Poor Organising & Management Skills, PS-2: Intricacies of Communication and PS-3: Callous Attitude, the results didn't reflect significant difference on personal stress with respect to gender grouping. This shows there is similarity of perception of the respondents on the personal stress based on gender grouping.

Thus, the hypothesis H_{2a} : there is a significant difference on the personal stress with respect to the different gender groups has been rejected.

Table 4.2.2.3 : ANOVA results factors influencing Personal Stress based on Age

		Sum of Squares	df	Mean Square	F	Sig.
PS-1: Poor Organising & Management Skills	Between Groups	.914	2	.457	.734	.481
	Within Groups	247.056	397	.622		
	Total	247.969	399			
PS-2: Intricacies of Communi- cation	Between Groups	4.265	2	2.132	2.958	.050*
	Within Groups	286.183	397	.721		
	Total	290.447	399			
PS-3: Callous Attitude	Between Groups	2.946	2	1.473	2.121	.121
	Within Groups	275.755	397	.695		
	Total	278.701	399			
PS-4: Perplexed Behavior	Between Groups	2.845	2	1.422	1.285	.278
	Within Groups	439.253	397	1.106		
	Total	442.098	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results (table 4.2.2.3) reflect that there is a significant difference in only one of the four factors influencing personal stress based on age groups considered for analysis.

This is: PS-2 : Intricacies of Communication, but for other three factors i.e. PS-1: Poor Organising & Management Skills, PS-3 : Callous Attitude and PS-4: Perplexed Behavior the results didn't reflect significant difference on personal stress with respect to age grouping. This shows there is similarity of perception of the respondents on the personal stress based on age grouping.

Table 4.2.2.4 : Tukey HSD Results for personal stress factors and different age groups

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PS-1: Poor Organising & Management Skills	<20	=20	.08720	.11045	.710	-.1726	.3470
		>20	-.01854	.10483	.983	-.2652	.2281
	=20	<20	-.08720	.11045	.710	-.3470	.1726
		>20	-.10574	.08950	.465	-.3163	.1048
	>20	<20	.01854	.10483	.983	-.2281	.2652
		=20	.10574	.08950	.465	-.1048	.3163
PS-2: Intricacies of Communication	<20	=20	.28388*	.11887	0.046*	.0042	.5635
		>20	.13725	.11283	.444	-.1282	.4027
	=20	<20	-.28388*	.11887	0.046*	-.5635	-.0042
		>20	-.14663	.09633	.282	-.3732	.0800
	>20	<20	-.13725	.11283	.444	-.4027	.1282
		=20	.14663	.09633	.282	-.0800	.3732
PS-3: Callous Attitude	<20	=20	.12047	.11669	.557	-.1540	.3950
		>20	-.07410	.11075	.782	-.3346	.1865
	=20	<20	-.12047	.11669	.557	-.3950	.1540
		>20	-.19457	.09456	.100	-.4170	.0279
	>20	<20	.07410	.11075	.782	-.1865	.3346
		=20	.19457	.09456	.100	-.0279	.4170
PS-4: Perplexed Behavior	<20	=20	.23040	.14727	.262	-.1161	.5769
		>20	.18043	.13978	.401	-.1484	.5093
	=20	<20	-.23040	.14727	.262	-.5769	.1161
		>20	-.04997	.11934	.908	-.3307	.2308
	>20	<20	-.18043	.13978	.401	-.5093	.1484
		=20	.04997	.11934	.908	-.2308	.3307

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.2.4. In case of PS-2 : Intricacies of Communication, there was a significant difference at age levels, (< 20 and > 20 years of age) and (= 20 and > 20 years of age).

Thus, the hypothesis H_{2b} : there is a significant difference in the personal stress with respect to the different age groups has been rejected.

Table 4.2.2.5 ANOVA results for factors influencing Personal stress based on Engineering Streams

		Sum of Squares	df	Mean Square	F	Sig.
PS-1: Poor Organising & Management Skills	Between Groups	6.551	3	2.184	3.582	0.014*
	Within Groups	241.419	396	.610		
	Total	247.969	399			
PS-2: Intricacies of Communication	Between Groups	4.092	3	1.364	1.887	.131
	Within Groups	286.355	396	.723		
	Total	290.447	399			
PS-3: Callous Attitude	Between Groups	5.606	3	1.869	2.710	0.045*
	Within Groups	273.094	396	.690		
	Total	278.701	399			
PS-4: Perplexed Behavior	Between Groups	56.212	3	18.737	19.229	0.000***
	Within Groups	385.885	396	.974		
	Total	442.097	399			

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ Sig: Significance;

ANOVA results (table 4.2.2.5) reflect that there is a significant difference in three of the four factors influencing personal stress based on engineering stream groups considered for analysis. This is: PS-1: Poor Organising & Management Skills, PS-3 : Callous Attitude and PS-4: Perplexed Behavior but for other one factor i.e. PS-2 : Intricacies of Communication, the results didn't reflect significant difference on personal stress with respect to engineering stream grouping. This shows there is difference of perception of the respondents on the personal stress based on engineering stream grouping.

Table 4.2.2.6 : Tukey HSD Results for personal stress factors and different engineering stream groups

Dependent Variable	(I) Stream	(J) Stream	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PS-1: Poor Organising & Management Skills	Civil	Computer	-.22000	.11042	.193	-.5049	.0649
		Electronics and Communication	-.35750*	.11042	0.007**	-.6424	-.0726
		Mechanical	-.21750	.11042	.201	-.5024	.0674
	Computer	Civil	.22000	.11042	.193	-.0649	.5049
		Electronics and Communication	-.13750	.11042	.598	-.4224	.1474
		Mechanical	.00250	.11042	1.000	-.2824	.2874
	Electronics and Communication	Civil	.35750*	.11042	0.007**	.0726	.6424
		Computer	.13750	.11042	.598	-.1474	.4224
		Mechanical	.14000	.11042	.584	-.1449	.4249
	Mechanical	Civil	.21750	.11042	.201	-.0674	.5024
		Computer	-.00250	.11042	1.000	-.2874	.2824
		Electronics and Communication	-.14000	.11042	.584	-.4249	.1449
PS-2: Intricacies of Communication	Civil	Computer	-.27500	.12026	.103	-.5853	.0353
		Electronics and Communication	-.20500	.12026	.323	-.5153	.1053
		Mechanical	-.17000	.12026	.492	-.4803	.1403
	Computer	Civil	.27500	.12026	.103	-.0353	.5853
		Electronics and Communication	.07000	.12026	.937	-.2403	.3803
		Mechanical	.10500	.12026	.819	-.2053	.4153
	Electronics and Communication	Civil	.20500	.12026	.323	-.1053	.5153
		Computer	-.07000	.12026	.937	-.3803	.2403
		Mechanical	.03500	.12026	.991	-.2753	.3453
	Mechanical	Civil	.17000	.12026	.492	-.1403	.4803
		Computer	-.10500	.12026	.819	-.4153	.2053
		Electronics and Communication	-.03500	.12026	.991	-.3453	.2753
PS-3: Callous Attitude	Civil	Computer	-.25970	.11744	.122	-.5627	.0433
		Electronics and Communication	-.19310	.11744	.355	-.4961	.1099
		Mechanical	-.31290*	.11744	0.040*	-.6159	-.0099
	Computer	Civil	.25970	.11744	.122	-.0433	.5627
		Electronics and Communication	.06660	.11744	.942	-.2364	.3696
		Mechanical	-.05320	.11744	.969	-.3562	.2498
	Electronics and	Civil	.19310	.11744	.355	-.1099	.4961
		Computer	-.06660	.11744	.942	-.3696	.2364

	Communication	Mechanical	-.11980	.11744	.738	-.4228	.1832
	Mechanical	Civil	.31290*	.11744	0.040*	.0099	.6159
		Computer	.05320	.11744	.969	-.2498	.3562
		Electronics and Communication	.11980	.11744	.738	-.1832	.4228
PS-4: Perplexed Behavior	Civil	Computer	-.88500*	.13960	0.000***	-1.2452	-.5248
		Electronics and Communication	-.91500*	.13960	0.000***	-1.2752	-.5548
		Mechanical	-.43000*	.13960	0.012*	-.7902	-.0698
	Computer	Civil	.88500*	.13960	0.000***	.5248	1.2452
		Electronics and Communication	-.03000	.13960	.996	-.3902	.3302
		Mechanical	.45500*	.13960	0.007**	.0948	.8152
	Electronics and Communication	Civil	.91500*	.13960	0.000***	.5548	1.2752
		Computer	.03000	.13960	.996	-.3302	.3902
		Mechanical	.48500*	.13960	0.003**	.1248	.8452
	Mechanical	Civil	.43000*	.13960	0.012*	.0698	.7902
		Computer	-.45500*	.13960	0.007**	-.8152	-.0948
		Electronics and Communication	-.48500*	.13960	0.003**	-.8452	-.1248

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.2.6. In case of PS-1: Poor Organising & Management Skills, PS-3 : Callous Attitude, PS-4: Perplexed Behavior there was a significant difference at all 4 levels of the engineering streams, (i.e. Civil, Electronics and Communication, Computer and Mechanical Engineering).

Thus, the hypothesis H_{2c}: there is a significant difference in the personal stress with respect to the different engineering stream groups has been accepted.

Table 4.2.2.7 ANOVA results for factors influencing Personal Stress based on Nature of University

		Sum of Squares	df	Mean Square	F	Sig.
PS-1: Poor Organising & Management Skills	Between Groups	1.051	1	1.051	1.693	.194
	Within Groups	246.919	398	.620		
	Total	247.969	399			
PS-2: Intricacies of Communication	Between Groups	.202	1	.202	.278	.599
	Within Groups	290.245	398	.729		
	Total	290.448	399			
PS-3: Callous Attitude	Between Groups	1.522	1	1.522	2.185	.140
	Within Groups	277.179	398	.696		
	Total	278.701	399			
PS-4: Perplexed Behavior	Between Groups	3.240	1	3.240	2.938	.087
	Within Groups	438.858	398	1.103		
	Total	442.098	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results reflect that there is no significant difference in perception of respondents in any of the four factors influencing personal stress based on university groups considered for analysis. The results are shown through Table 4.2.2.7. This is: PS-1: Poor Organising & Management Skills, PS-2: Intricacies of Communication PS-3: Callous Attitude PS4: the results didn't reflect significant difference on personal stress with respect to university grouping. This shows there is similarity of perception of the respondents on the personal stress based on university grouping.

Thus, the hypothesis H_{2d} : there is a significant difference in the personal stress with respect to the different university groups has been rejected

4.2.3 Financial Stress

Attempt was made to compare financial stress based on gender, age, engineering streams and nature of university. The following hypotheses have been framed:

H_3 : There is a significant difference in the financial stress based on gender, age, engineering streams and nature of university.

H_{3a} : There is a significant difference in the financial stress based on gender.

H_{3b} : There is a significant difference in the financial stress based on age.

H_{3c} : There is a significant difference in the financial stress based on engineering streams.

H_{3d}: There is a significant difference in the financial stress based on nature of University.

ANOVA has been used to test the hypotheses and for intergroup comparisons Post hoc Tukey has been used.

Table 4.2.3.1 Factor analysis for identification of factors affecting Financial Stress

Factor Name	Items	Factor Loading	Eigen Value	% of Variance	C	AVE	CR
FS-1: Financial Crunch	FS5: High Expenses of books and study material	.845	30.639	30.639	30.639	.527	.812
	FS6: Identity crisis due to the strong financial conditions of peers	.829					
	FS7: Low package	.595					
	FS4: Feel the need of the job due to family financial crisis	.594					
FS-2: Difficulty in Managing Expenditure	FS2: Burden of interest on bank loans	.817	28.055	28.055	58.693	.597	.816
	FS1: Low family income	.774					
	FS3: High fees of institute	.725					

C: Cumulative; AVE: Average variance extracted; CR: Composite Reliability

The results of factor analysis as shown through Table 4.2.3.1 which highlight that based on factor analysis two factors emerged. These two factors explained 58.693 % of variation. The first factor viz. **FS-1** : Financial Crunch had Eigen Value 30.639 and explained 30.639% of variation.

The two items, viz. FS5: High Expenses of books and study material loaded 0.845 and FS6: Identity crisis due to the strong financial conditions of peers loaded 0.829

signifying higher importance than other factors. The composite reliability is 0.812 and Average variance extracted is 0.527. This suggests high construct reliability for this factor.

The Second factor **FS-2 : Difficulty in Managing Expenditure** had Eigen Value 28.055 and explained 28.055 % of variation. It had three components. The first component FS2: Burden of interest on bank loans had loading of 0.817 and second component FS1: Low family income got loaded with 0.774 showing their high effect. The composite reliability is 0.816 and Average variance extracted is 0.597. This recommends elevated construct reliability for this factor.

Table 4.2.3.2 ANOVA results for factors influencing Financial Stress based on Gender

		Sum of Squares	Df	Mean Square	F	Sig.
FS-1: Financial Crunch	Between Groups	5.161	1	5.161	5.543	0.019*
	Within Groups	370.591	398	.931		
	Total	375.753	399			
FS-2: Difficulty in Managing Expenditure	Between Groups	7.184	1	7.184	6.230	0.013*
	Within Groups	458.951	398	1.153		
	Total	466.134	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results reflect that there is significant difference in perception of respondents in both the two factors influencing financial stress based on gender groups considered for analysis. As shown in table 4.2.3.2, in case of FS-1 : Financial Crunch and FS- 2 : Inadequacy in Managing Finances, the results reflected significant difference on financial stress with respect to gender grouping. This shows there is difference of perception of the respondents on the financial stress based on gender grouping.

Thus, the hypothesis H_{3a}: there is a significant difference in the financial stress with respect to the different gender groups has been accepted.

Table 4.2.3.3 : ANOVA results factors influencing Financial Stress based on Age

		Sum of Squares	df	Mean Square	F	Sig.
FS-1: Financial Crunch	Between Groups	2.640	2	1.320	1.405	.247
	Within Groups	373.112	397	.940		
	Total	375.753	399			
FS-2: Difficulty in Managing Expenditure	Between Groups	3.520	2	1.760	1.510	.222
	Within Groups	462.614	397	1.165		
	Total	466.134	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results as shown in table 4.2.3.3 reflect that there is no significant difference in any of the two factors influencing financial stress based on age groups considered for analysis. This shows there is similarity of perception of the respondents on the financial stress based on age grouping.

Table 4.2.3.4 : Post-hoc Tukey HSD Results for Financial Stress factors and different age groups

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
FS-1: Financial Crunch	<20	=20	.21617	.13573	.250	-.1031	.5355
		>20	.18533	.12883	.322	-.1177	.4884
	=20	<20	-.21617	.13573	.250	-.5355	.1031
		>20	-.03084	.10999	.958	-.2896	.2279
	>20	<20	-.18533	.12883	.322	-.4884	.1177
		=20	.03084	.10999	.958	-.2279	.2896
FS-2: Difficulty in Managing Expenditure	<20	=20	.26268	.15114	.192	-.0929	.6182
		>20	.16334	.14345	.491	-.1741	.5008
	=20	<20	-.26268	.15114	.192	-.6182	.0929
		>20	-.09935	.12247	.696	-.3875	.1888
	>20	<20	-.16334	.14345	.491	-.5008	.1741
		=20	.09935	.12247	.696	-.1888	.3875

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.3.4. In case of FS-1 : Financial Crunch and FS-2 : Difficulty in

Managing Expenditure, there was no significant difference between different age levels, (i.e. groups < 20, = 20 and > 20 years of age).

Thus, the hypothesis H_{3b} : there is a significant difference in the financial stress with respect to the different age groups has been rejected.

Table 4.2.3.5 : ANOVA results for Engineering Stream groups and factors influencing Financial Stress

		Sum of Squares	df	Mean Square	F	Sig.
FS-1: Financial Crunch	Between Groups	8.939	3	2.980	3.217	0.023*
	Within Groups	366.814	396	.926		
	Total	375.753	399			
FS-2: Difficulty in Managing Expenditure	Between Groups	3.183	3	1.061	.908	.437
	Within Groups	462.951	396	1.169		
	Total	466.134	399			

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

ANOVA results as per table 4.2.3.5, reflect that there is a significant difference in the perception of respondents in one of the two factors influencing financial stress based on engineering streams considered for analysis. This is: FS-1: Financial Crunch but for FS-2: Difficulty in Managing Expenditure the results didn't reflect significant difference on financial stress with respect to engineering stream grouping. This shows there is similarity of perception of the respondents on the financial stress based on engineering stream grouping.

Table 4.2.3.6 : Tukey HSD Results for financial stress factors and different engineering stream groups

Dependent Variable	(I) Stream	(J) Stream	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
FS-1: Financial Crunch	Civil	Computer	.06250	.13611	.968	-.2887	.4137
		Electronics and Communication	-.32750	.13611	.078	-.6787	.0237
		Mechanical	-.13500	.13611	.754	-.4862	.2162
	Computer	Civil	-.06250	.13611	.968	-.4137	.2887
		Electronics and Communication	-.39000*	.13611	0.023*	-.7412	-.0388
		Mechanical	-.19750	.13611	.468	-.5487	.1537
	Electronics and Communication	Civil	.32750	.13611	.078	-.0237	.6787
		Computer	.39000*	.13611	0.023*	.0388	.7412
		Mechanical	.19250	.13611	.491	-.1587	.5437
	Mechanical	Civil	.13500	.13611	.754	-.2162	.4862
		Computer	.19750	.13611	.468	-.1537	.5487
		Electronics and Communication	-.19250	.13611	.491	-.5437	.1587
FS-2: Difficulty in Managing Expenditure	Civil	Computer	.16310	.15291	.710	-.2314	.5576
		Electronics and Communication	.15670	.15291	.735	-.2378	.5512
		Mechanical	-.03370	.15291	.996	-.4282	.3608
	Computer	Civil	-.16310	.15291	.710	-.5576	.2314
		Electronics and Communication	-.00640	.15291	1.000	-.4009	.3881
		Mechanical	-.19680	.15291	.572	-.5913	.1977
	Electronics and Communication	Civil	-.15670	.15291	.735	-.5512	.2378
		Computer	.00640	.15291	1.000	-.3881	.4009
		Mechanical	-.19040	.15291	.598	-.5849	.2041
	Mechanical	Civil	.03370	.15291	.996	-.3608	.4282
		Computer	.19680	.15291	.572	-.1977	.5913
		Electronics and Communication	.19040	.15291	.598	-.2041	.5849

*** p<0.001; ** p<0.01; * p<0.05

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.3.6. In case of FS-1: Financial Crunch there was a significant difference at two levels of the engineering streams, (i.e. Computer and Electronics and Communication Engineering).

Thus, the hypothesis H_{3c} : there is a significant difference in the financial stress with respect to the different engineering stream groups has been partially accepted.

Table 4.2.3.7 : ANOVA results for factors influencing Financial Stress based on Nature of University

		Sum of Squares	Df	Mean Square	F	Sig.
FS-1: Financial Crunch	Between Groups	5.760	1	5.760	6.196	0.013*
	Within Groups	369.993	398	.930		
	Total	375.753	399			
FS-2: Difficulty in Managing Expenditure	Between Groups	.747	1	.747	.639	.424
	Within Groups	465.387	398	1.169		
	Total	466.134	399			

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

ANOVA results (table 4.2.3.7) reflect that there is significant difference in perception of respondents in one of the two factors influencing financial stress based on university groups considered for analysis. This is: FS-1 : Financial Crunch but in FS- 2 the results didn't reflect significant difference on financial stress with respect to university grouping. This shows there is similarity (for first factor FS-1) but difference of perception (for second factor FS-2 Difficulty in Managing Expenditure) of the respondents on the financial stress based on university grouping.

Thus, the hypothesis H_{3d} : there is a significant difference in the financial stress with respect to the different university groups has been partially accepted.

4.2.4 Stress Relieving Strategies

Based on gender, age, engineering streams and nature of university, the Stress Relieving Strategies have been investigated. Hence the following hypotheses have been framed:

H_4 : There is a significant difference in the Stress Relieving Strategies based on gender, age, engineering streams and nature of university.

H_{4a} : There is a significant difference in the Stress Relieving Strategies based on gender.

H_{4b} : There is a significant difference in the Stress Relieving Strategies based on age.

H_{4c} : There is a significant difference in the Stress Relieving Strategies based on engineering streams.

H_{4d} : There is a significant difference in the Stress Relieving Strategies based on nature of university.

ANOVA has been used to test the hypotheses and for intergroup comparisons Post hoc Tukey has been used.

Table 4.2.4.1: Factor analysis for identification of factors affecting Stress Relieving Strategies

Factor Name	Items	Factor Loading	Eigen Value	% of Variance	C	AVE	CR
SRS-1: Peer Assistance and Family support	SRS3: Seek comfort and help from family and friends	.761	15.097	15.097	15.097	.428	.726
	SRS4: Think through different ways to handle the situation	.751					
	SRS13: Share with someone who has faced similar situation	.631					
	SRS2: Look at the problem objectively	.578					
	SRS11: My friends / relatives remain ready to help me in the difficult times	.516					
SRS-2: Resorting to unfavorable Practices	SRS10: Drink alcoholic beverages	.769	10.305	10.305	25.402	.472	.722
	SRS1: Eat, Smoke or chew gum	.758					
	SRS7: Blame someone else for your problems	.500					

SRS-3: Withdrawal Symptoms & Delegating job to others	SRS9: Let someone else solve the problem	.686	9.763	9.763	35.165	.418	.683
	SRS15: Withdraw from the situation	.647					
	SRS12: Resign yourself to the situation because things look hopeless	.605					
SRS-4: Procrastination	SRS16: Release tension with physical activity	.773	9.510	9.510	44.676	.406	.667
	SRS18: Listen to music to release tension	.565					
	SRS14: Go to sleep, figuring things will look better in the morning	.550					
SRS-5: Resorting to Stress Alleviation Techniques	SRS8: Practice meditation and yoga as stress relievers	.655	6.443	6.443	51.119	.414	.585
	SRS6: Day dream, fantasize	-.631					

C: Cumulative; AVE: Average variance extracted; CR: Composite Reliability

The results of factor analysis as shown through Table 4.2.4.1, highlight that based on factor analysis five factors emerged. These five factors explained 51.119 % of variation. The first factor viz. **SRS-1:** Peer Assistance and Family support had Eigen Value 15.097 and explained 15.097 % of variation. The first two items, viz. SRS3: Seek comfort and help from family and friends and SRS4: Think through different ways to handle the situation were loaded heavily (as 0.761 and 0.751 respectively) signifying higher importance than other factors. The composite reliability is 0.726 and Average variance extracted is 0.428. This suggests high construct reliability for this factor. **SRS-2:** Resorting to unfavorable Practices had three items only viz. i.) SRS10: Drink alcoholic beverages with item loading of 0.769 and SRS1: Eat, Smoke or chew gum loaded with

0.758. The average variance extracted is 0.472 and Composite reliability is 0.722. The values are important.

SRS-3: With-drawl Symptoms & Delegating job to others explained 9.763 % of Variation. Its first component SRS9: Let someone else solve the problem had loading of 0.686. The average variance extracted is 0.418 and Composite reliability is 0.683 are both in acceptable range.

The next factor viz. **SRS-4:** Procrastination explained 9.510 % of Variation. The first item, SRS16: Release tension with physical activity loaded high as 0.773. The Composite reliability is 0.667 and Average variance extracted is 0.406. The fifth factor is **SRS-5:** Resorting to Stress Alleviation Techniques explained variance of 6.443 % and had eigen value of 6.443. It had two items (loaded as 0.655 and 0.631), SRS8: Practice meditation and yoga as stress relievers. SRS6: Day dream, fantasize are important. The composite reliability is 0.585 and average variance extracted is 0.414 are both in acceptable range.

Table 4.2.4.2 : ANOVA results for Gender groups and factors influencing Stress Relieving Strategies

		Sum of Squares	df	Mean Square	F	Sig.
SRS-1: Peer Assistance and Family support	Between Groups	5.682	1	5.682	6.961	.009**
	Within Groups	324.874	398	.816		
	Total	330.556	399			
SRS-2: Resorting to unfavorable Practices	Between Groups	6.865	1	6.865	7.066	.008**
	Within Groups	386.670	398	.972		
	Total	393.535	399			
SRS-3: Withdrawl Symptoms & Delegating job to others	Between Groups	.885	1	.885	.983	.322
	Within Groups	358.499	398	.901		
	Total	359.384	399			
SRS-4: Procrastination	Between Groups	.979	1	.979	.993	.320

	Within Groups	392.265	398	.986		
	Total	393.243	399			
SRS-5: Resorting to Stress Alleviation Techniques	Between Groups	.180	1	.180	.207	.650
	Within Groups	346.360	398	.870		
	Total	346.540	399			

*** p<0.001; ** p<0.01; * p<0.05

As shown in the table 4.2.4.2, ANOVA results reflect that there is no significant difference in perception of respondents in three of the five factors (SRS-3: With-drawl Symptoms & Delegating job to others, SRS-4: Procrastination, SRS-5: Resorting to Stress Alleviation Techniques influencing Stress Relieving Strategies based on gender groups considered for analysis. But other two factors i.e. SRS-1: Peer Assistance and Family support, SRS-2: Resorting to unfavorable Practices, the results reflect significant difference on Stress Relieving Strategies with respect to gender grouping. This shows there is more similarity of perception of the respondents on the Stress Relieving Strategies based on gender grouping.

Thus, the hypothesis H_{4a}: there is a significant difference in the Stress Relieving Strategies with respect to the different gender groups has been partially accepted.

Table 4.2.4.3 : ANOVA results factors influencing Stress Relieving Strategies based on Age

		Sum of Squares	df	Mean Square	F	Sig.
SRS-1: Peer Assistance and Family support	Between Groups	1.614	2	.807	.974	.378
	Within Groups	328.942	397	.829		
	Total	330.556	399			
SRS-2: Resorting to unfavorable Practices	Between Groups	2.309	2	1.154	1.171	.311
	Within Groups	391.226	397	.985		
	Total	393.535	399			
SRS-3: Withdrawl Symptoms &	Between Groups	5.529	2	2.764	3.101	0.046*
	Within Groups	353.856	397	.891		

Delegating job to others	Total	359.384	399			
SRS-4: Procrastination	Between Groups	.231	2	.115	.117	.890
	Within Groups	393.013	397	.990		
	Total	393.243	399			
SRS-5: Resorting to Stress Alleviation Techniques	Between Groups	.285	2	.143	.164	.849
	Within Groups	346.255	397	.872		
	Total	346.540	399			

*** p<0.001; ** p<0.01; * p<0.05

As indicated in table 4.2.4.3, ANOVA results reflect that there is no significant difference in any of the five factors influencing Stress Relieving Strategies based on age groups considered for analysis. This shows there is similarity of perception of the respondents on the Stress Relieving Strategies based on age grouping.

Table 4.2.4.4 : Tukey HSD Results for Stress Relieving Strategies factors and different age groups

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
SRS-1: Peer Assistance and Family support	<20	=20	.03590	.12744	.957	-.2639	.3357
		>20	-.10256	.12096	.673	-.3871	.1820
	=20	<20	-.03590	.12744	.957	-.3357	.2639
		>20	-.13846	.10327	.373	-.3814	.1045
	>20	<20	.10256	.12096	.673	-.1820	.3871
		=20	.13846	.10327	.373	-.1045	.3814
SRS-2: Resorting to unfavorable Practices	<20	=20	.21270	.13899	.278	-.1143	.5397
		>20	.12913	.13192	.591	-.1812	.4395
	=20	<20	-.21270	.13899	.278	-.5397	.1143
		>20	-.08357	.11263	.739	-.3485	.1814
	>20	<20	-.12913	.13192	.591	-.4395	.1812
		=20	.08357	.11263	.739	-.1814	.3485
SRS-3: Withdrawal Symptoms & Delegating job to others	<20	=20	.25878	.13218	.124	-.0522	.5697
		>20	.01513	.12546	.992	-.2800	.3103
	=20	<20	-.25878	.13218	.124	-.5697	.0522
		>20	-.24365	.10711	.061	-.4956	.0083
	>20	<20	-.01513	.12546	.992	-.3103	.2800
		=20	.24365	.10711	.061	-.0083	.4956
SRS-4: Procrastination	<20	=20	.06329	.13930	.893	-.2644	.3910
		>20	.02302	.13222	.983	-.2880	.3341
	=20	<20	-.06329	.13930	.893	-.3910	.2644

SRS-5: Resorting to Stress Alleviation Techniques	>20	>20	-.04028	.11288	.932	-.3058	.2253
		<20	-.02302	.13222	.983	-.3341	.2880
		=20	.04028	.11288	.932	-.2253	.3058
	<20	=20	-.00483	.13076	.999	-.3124	.3028
		>20	.05048	.12411	.913	-.2415	.3424
	=20	<20	.00483	.13076	.999	-.3028	.3124
		>20	.05531	.10596	.861	-.1940	.3046
	>20	<20	-.05048	.12411	.913	-.3424	.2415
		=20	-.05531	.10596	.861	-.3046	.1940

*** p<0.001; ** p<0.01; * p<0.05 Sig: Significance;

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.4.4. In case of SRS-1: Peer Assistance and Family support, SRS-2: Resorting to unfavorable Practices, SRS-3: With-drawl Symptoms & Delegating job to others, SRS-4: Procrastination and SRS-5: Resorting to Stress Alleviation Techniques, there was no significant difference amongst all 3 age levels, (i.e. groups < 20, = 20 and > 20 years of age).

Thus, the hypothesis H_{4b}: there is a significant difference in the Stress Relieving Strategies with respect to the different age groups has been rejected.

Table 4.2.4.5 : ANOVA results factors influencing Stress Relieving Strategies Engineering Streams

		Sum of Squares	df	Mean Square	F	Sig.
SRS-1: Peer Assistance and Family support	Between Groups	17.341	3	5.780	7.308	0.000***
	Within Groups	313.215	396	.791		
	Total	330.556	399			
SRS-2: Resorting to unfavorable Practices	Between Groups	14.400	3	4.800	5.014	0.002**
	Within Groups	379.135	396	.957		
	Total	393.535	399			
SRS-3: With- drawl Symptoms & Delegating job to others	Between Groups	.292	3	.097	.107	.956
	Within Groups	359.092	396	.907		
	Total	359.384	399			

SRS-4: Procrastination	Between Groups	9.280	3	3.093	3.190	0.024*
	Within Groups	383.964	396	.970		
	Total	393.243	399			
SRS-5: Resorting to Stress Alleviation Techniques	Between Groups	1.595	3	.532	.610	.609
	Within Groups	344.945	396	.871		
	Total	346.540	399			

*** p<0.001; ** p<0.01; * p<0.05

The table 4.2.4.5 projects the ANOVA results and shows there is a significant difference in perception of respondents in three of the five factors influencing stress relieving strategy based on engineering streams considered for analysis. This is: SRS-1: Peer Assistance and Family support, SRS-2: Resorting to unfavorable Practices and SRS-4: Procrastination but for other factors i.e. SRS-3: With-drawl Symptoms & Delegating job to others and SRS-5: Resorting to Stress Alleviation Techniques the results didn't reflect significant difference on stress relieving strategy with respect to engineering stream grouping. This shows there is more difference in perception of the respondents on the stress relieving strategy based on engineering stream grouping.

Table 4.2.4.6 : Tukey HSD Results for Stress Relieving Strategies factors and different engineering stream groups

Dependent Variable	(I) Stream	(J) Stream	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
SRS-1: Peer Assistance and Family support	Civil	Computer	-.54600*	.12577	0.000***	-.8705	-.2215
		Electronics and Communication	-.45600*	.12577	0.002**	-.7805	-.1315
		Mechanical	-.28200	.12577	.114	-.6065	.0425
	Computer	Civil	.54600*	.12577	0.000***	.2215	.8705
		Electronics and Communication	.09000	.12577	.891	-.2345	.4145
		Mechanical	.26400	.12577	.155	-.0605	.5885
	Electronics and Communication	Civil	.45600*	.12577	0.002**	.1315	.7805
		Computer	-.09000	.12577	.891	-.4145	.2345
		Mechanical	.17400	.12577	.510	-.1505	.4985
	Mechanical	Civil	.28200	.12577	.114	-.0425	.6065
		Computer	-.26400	.12577	.155	-.5885	.0605
		Electronics and Communication	-.17400	.12577	.510	-.4985	.1505

SRS-2: Resorting to unfavorable Practices	Civil	Computer	.37040*	.13838	0.039*	.0134	.7274
		Electronics and Communication	.35330	.13838	.054	-.0037	.7103
		Mechanical	-.03340	.13838	.995	-.3904	.3236
	Computer	Civil	-.37040*	.13838	0.039*	-.7274	-.0134
		Electronics and Communication	-.01710	.13838	.999	-.3741	.3399
		Mechanical	-.40380*	.13838	0.019*	-.7608	-.0468
	Electronics and Communication	Civil	-.35330	.13838	.054	-.7103	.0037
		Computer	.01710	.13838	.999	-.3399	.3741
		Mechanical	-.38670*	.13838	0.028*	-.7437	-.0297
	Mechanical	Civil	.03340	.13838	.995	-.3236	.3904
		Computer	.40380*	.13838	0.019*	.0468	.7608
		Electronics and Communication	.38670*	.13838	0.028*	.0297	.7437
SRS-3: With-drawl Symptoms & Delegating job to others	Civil	Computer	.05030	.13467	.982	-.2971	.3977
		Electronics and Communication	-.02000	.13467	.999	-.3674	.3274
		Mechanical	-.00990	.13467	1.000	-.3573	.3375
	Computer	Civil	-.05030	.13467	.982	-.3977	.2971
		Electronics and Communication	-.07030	.13467	.954	-.4177	.2771
		Mechanical	-.06020	.13467	.970	-.4076	.2872
	Electronics and Communication	Civil	.02000	.13467	.999	-.3274	.3674
		Computer	.07030	.13467	.954	-.2771	.4177
		Mechanical	.01010	.13467	1.000	-.3373	.3575
	Mechanical	Civil	.00990	.13467	1.000	-.3375	.3573
		Computer	.06020	.13467	.970	-.2872	.4076
		Electronics and Communication	-.01010	.13467	1.000	-.3575	.3373
SRS-4: Procrastination	Civil	Computer	-.40880*	.13926	0.018*	-.7681	-.0495
		Electronics and Communication	-.31600	.13926	.107	-.6753	.0433
		Mechanical	-.20630	.13926	.450	-.5656	.1530
	Computer	Civil	.40880*	.13926	0.018*	.0495	.7681
		Electronics and Communication	.09280	.13926	.910	-.2665	.4521
		Mechanical	.20250	.13926	.466	-.1568	.5618
	Electronics and Communication	Civil	.31600	.13926	.107	-.0433	.6753
		Computer	-.09280	.13926	.910	-.4521	.2665
		Mechanical	.10970	.13926	.860	-.2496	.4690
	Mechanical	Civil	.20630	.13926	.450	-.1530	.5656
		Computer	-.20250	.13926	.466	-.5618	.1568
		Electronics and Communication	-.10970	.13926	.860	-.4690	.2496
SRS-5: Resorting to Stress Alleviation	Civil	Computer	.06500	.13199	.961	-.2755	.4055
		Electronics and Communication	-.11000	.13199	.839	-.4505	.2305
		Mechanical	-.03500	.13199	.993	-.3755	.3055

Techniques	Computer	Civil	-.06500	.13199	.961	-.4055	.2755
		Electronics and Communication	-.17500	.13199	.547	-.5155	.1655
		Mechanical	-.10000	.13199	.873	-.4405	.2405
	Electronics and Communication	Civil	.11000	.13199	.839	-.2305	.4505
		Computer	.17500	.13199	.547	-.1655	.5155
		Mechanical	.07500	.13199	.941	-.2655	.4155
	Mechanical	Civil	.03500	.13199	.993	-.3055	.3755
		Computer	.10000	.13199	.873	-.2405	.4405
		Electronics and Communication	-.07500	.13199	.941	-.4155	.2655

*** p<0.001; ** p<0.01; * p<0.05 Sig: Significance;

Post-hoc Tukey was conducted to have clarity on the differences. The results are shown through Table 4.2.4.6. In case of SRS-1: Peer Assistance and Family support, SRS-2: Resorting to unfavorable Practices and SRS-4: Procrastination there was a significant difference at all 4 levels of the engineering streams, (i.e. Civil, Electronics and Communication, Computer and Mechanical Engineering).

Thus, the hypothesis H_{4c}: there is a significant difference in the stress relieving strategy with respect to the different engineering stream groups has been partially accepted.

Table 4.2.4.7 ANOVA results for factors influencing Stress Relieving Strategies based on Nature of the University

		Sum of Squares	df	Mean Square	F	Sig.
SRS-1: Peer Assistance and Family support	Between Groups	.336	1	.336	.405	.525
	Within Groups	330.220	398	.830		
	Total	330.556	399			
SRS-2: Resorting to unfavorable Practices	Between Groups	.466	1	.466	.472	.493
	Within Groups	393.069	398	.988		
	Total	393.535	399			
SRS-3: Withdrawal Symptoms & Delegating job to others	Between Groups	.010	1	.010	.011	.917
	Within Groups	359.375	398	.903		
	Total	359.384	399			
SRS-4: Procrastination	Between Groups	.135	1	.135	.137	.712
	Within Groups	393.108	398	.988		
	Total	393.243	399			
SRS-5:	Between Groups	.010	1	.010	.011	.915

Resorting to Stress Alleviation Techniques	Within Groups	346.530	398	.871		
	Total	346.540	399			

*** p<0.001; ** p<0.01; * p<0.05

ANOVA results reflect that there is no significant difference in perception of respondents in any of the five factors influencing Stress Relieving Strategies based on university groups considered for analysis. The results are as shown in table 4.2.4.7. This for SRS-1: Peer Assistance and Family support, SRS-2: Resorting to .unfavorable Practices, SRS-3: With-drawl Symptoms & Delegating job to others, SRS-4: Procrastination, SRS-5: Resorting to Stress Alleviation Techniques the results didn't reflect significant difference on Stress Relieving Strategies with respect to university grouping. This shows there is similarity of perception of the respondents on the Stress Relieving Strategies based on university grouping.

Thus, the hypothesis H_{4d}: there is a significant difference in the Stress Relieving Strategies with respect to the different university groups has been rejected.

Hence this objective O1: To identify the factors leading to Stress in Engineering Students of a Government University (Punjabi University, Patiala) and Private University (Thapar University, Patiala) was achieved.

The next step of research was to measure stress through GSR (Skin Conductance) to identify students with high stress level.

4.3 Identification of High Stress Level

The second objective of the research was:

O2: To measure stress through GSR (Skin Conductance) to identify students with high stress level.

The experimental group was selected based on self reporting and validated through GSR readings. They revealed willingness for various drills and they wished to get their GSR level monitored through GSR sensor meter. The mean GSR value (pre) for Experimental Groups was noted to proceed further. In Table 4.3.1 mean GSR Value (pre) for Experimental Groups for all stimuli is shown.

Hence this objective O2: To measure stress through GSR (Skin Conductance) to identify students with high stress level was achieved.

Table 4.3.1 : Mean GSR Value (pre) for Control and Experimental Groups for all stimuli

S No.	Type of Stimulus	Mean GSR value (siemen)	t = 0 second (Pre Value)
1.	No Drill: Control Group	Mean Value for Control Group	63.58
2.	Undergoing Yogic Breathing	Mean Value for Experimental Group	71.14
3.	Listening to Musical Hymns	Mean Value for Experimental Group	69.39
4.	Listening to Flute Music	Mean Value for Experimental Group	70.23
5.	Listening to Saxophone Music	Mean Value for Experimental Group	69.98

The results do reflect higher stress levels of students who reported high stress as has been reflected through the higher readings of experimental group at t=0 second.

After identification of the students for Experimental group, the next step was to apply stress management strategies chosen for experimentation, viz. i) Yogic breathing; ii) listening to musical religious hymns; iii) listening to Flute music; and iv) listening to Saxophone music.

This has been discussed in next section.

4.4 Monitoring Stress Level under stimuli

The third objective of the research was:

O3: To Monitor Stress Level using Digital Electronic Instrument (GSR meter) through various Stimuli under study.

Testing with GSR was carried out with following different stimuli

- i. Undergoing Yoga (Undergoing Yogic Breathing)
- ii. Undergoing Meditation (Listening to Musical Religious Hymns)
- iii. Listening to Indian Classical Instrumental Music (Flute)

iv. Listening to Western Instrumental Music (Saxophone)

This objective was achieved as per following details

4.4.1 Monitoring Stress Level under stimuli of Yogic Breathing

The related hypotheses are:

H₅: There is a significant difference in the mean GSR value of control group (not exposed to undergoing yogic breathing exercise) for t=zero second (before) and t=300 seconds (after).

H₆ : There is a significant difference in the mean GSR value of experimental group (undergoing yogic breathing) for t=zero second (before) and t=300 seconds (after).

H₇: There is a significant difference in mean GSR value of control group (not exposed to undergoing yogic breathing exercise) and experimental group (exposed to undergoing yogic breathing exercise) at t = zero second.

H₈: There is a significant difference in mean GSR value of control group (not exposed to undergoing yogic breathing exercise) and experimental group (exposed to undergoing yogic breathing exercise) at t =300 seconds.

The results of the study have been discussed in this section for the control and experimental group t-test has been used for studying the differences.

Table 4.4.1.1 : Results of t- test Analysis for Yogic Breathing (different time interval)

t-Test: Two Sample for Means	Control Group (No Treatment)		Experimental Group (undergoing Yogic Breathing)	
	t = 0 second (Pre)	t = 300 seconds (Post)	t = 0 second (Pre)	t = 300 seconds (Post)
Mean	63.58	68.69	71.14	63.95
Known Variance	199.41	208.99	237.29	286.95
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-11.97		17.18	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

**Table 4.4.1.2 : Results of t-test Analysis for Yogic Breathing
(same time interval)**

t-Test: Two Sample for Means	Control Group	Experimental Group	Control Group	Experimental Group
	t = 0 second (Pre)	t = 0 second (Pre)	t = 300 seconds (Post)	t = 300 seconds (Post)
Mean	63.58	71.14	68.69	63.95
Known Variance	199.41	237.29	208.99	286.9
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-11.16		7.2	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Control Group

The Control Group (Table 4.4.1.1) showed mean GSR value = 63.58 (pre) without undergoing yogic breathing at (t= 0 second) and value of mean GSR = 68.69 (post) without undergoing yogic breathing (t=300 seconds) with a variance of 199.41 and 208.99 respectively. Also, t Stat = 11.97 > t Critical two-tail (2.6). The p value (two-tail) < 0.01, was significant. So, Hypothesis H₅ was accepted. Thus, there was significant difference in the mean GSR value of students who comprised of population without undergoing yogic breathing (pre and post). Their mean value increased from 63.58 (t = 0 second) to 68.69 (t = 300 seconds), conveying increased in mean GSR value of the control group.

Experimental Group

The Experimental Group (Table 4.4.1.1) showed mean value of mean GSR value in students undergoing yogic breathing as 71.14 at t=0 second (pre), 63.95 at t=300 seconds (post) and a variance of 237.29 and 286.95 respectively. The mean value of pre (71.14) > mean value of post (63.95) at t Stat = 17.18 > t Critical two-tail (2.60). The p value (two-tail) < 0.01, was significant.

So, Hypothesis H₆ was accepted. Thus, there was significant difference in the mean GSR value between pre and post participants undergoing yogic breathing. However, mean value decreased from 71.14 (t = 0 second) to 63.95 (t = 300 seconds) which showed that mean GSR value decreased for the experimental group.

However, Table 4.4.1.2 shows mean GSR value at t=0 second, between control group and experimental group were 63.58 (pre) and 71.14 (pre) with a variance of 199.41 and 237.29 respectively, which shows increase in mean GSR value for experimental group as compared to the control group. The value of t Stat = 11.16 > t Critical two-tail (2.60). The p value (two-tail) is < 0.01 (significant level). So, Hypothesis H₇ is accepted. Thus, there is significant difference in the mean GSR value for both groups at t=0 second.

Table 4.4.1.2 shows mean GSR value at t=300 seconds, for control group and experimental group, were 68.69 (post) and 63.95 (post) with a variance of 208.99 and 286.90 respectively. The mean value for control (68.69) is more than experimental (63.95) and t Stat = 7.20 > t Critical two-tail (2.6). The p value (two-tail) is < 0.01, was significant. Therefore, Hypothesis H₈ is accepted.

Thus, it signifies difference in mean GSR value which decreases from 68.69 for control group to 63.95 for experimental group at t = 300 seconds.

However, overall assessment of (Table 4.5.1) shows decrease in mean GSR value after yogic breathing from 71.14 (pre) to 63.95 (post) as compared to control group whose mean value increases from 63.58 (pre) to 68.69 (post) respectively. This establishes beneficial effects of yogic breathing.

Discussion

Stress is an internal state which makes physical demands from the body or environmental and social situations that are evaluated as potentially harmful, uncontrollable, or exceeding our resources to cope with especially professional stress (Aggarwal *et al.*, 2007 ; Darshan *et al.*, 2013). Mental disorders have been described as one of the most devastating disorders of mankind (Math & Srinivasaraju, 2010). Some people are better in coping with stressors as they seek information about how to deal with problem, actively participate to reduce its impact, flexible and use cognitive reappraisal mechanism to deal with the situation. GSR reflects sweat gland activity, changes in the sympathetic nervous system, and results in increase conductance (Fuller, 1977). The study reported an

increase in the mean GSR in participants who have undergone without yogic breathing from 63.58 (t = 0 second) to 68.69 (t = 300 seconds) in the control group probably due to anticipated anxiety.

Joshi, Singh and Sharma, (2011) proposed developmental model for stress management laboratories in academic institutions using modern electronic instruments by monitoring physiological changes to achieve peak potential performance. Another technique used for enhancing cognitive abilities is yoga, with alternate nostril breathing pranayama (one of the oldest yoga) to reduce mental stress, increase physical strength and improves health (Joshi, Singla, Singh and Singh, 2011). Yoga is highly effective in the treatment of mental illness and improves the quality-of-life (Rao *et al.*, 2013; Hariprasad *et al.*, 2013). Joshi Kiran and Sah (2016) proved Deep breathing technique is able to control blood pressure and in turn the level of stress of engineering students. However, in the present study mean value of GSR decreased after yogic technique of yogic breathing in experimental group from 71.14 (t = 0 second) to 63.95 (t = 300 seconds). GSR is an indicator of psycho-physiological arousal. During stress, sweat gland activity rises in ducts, spreads laterally, hydrating stratum corneum of skin and thus reducing resistance by increasing conductance (Boucsein, 2012). It provides information about the influences from internal or external environment that otherwise are hidden and reflect the ways people make decisions and form judgments. (Bechara *et al.*, 2005 & Dunn *et al.*, 2006). Montagna, (2012) found epidermal membranes of the skin becoming permeable to neural stimuli that decreases skin resistance and increases conductivity.^[24] Meditation has a remarkable effect on the mental states of practitioner and significantly decreases GSR value (Snyder, 1990; Woodhouse, 1994 and Stanley, 2012). In our study, there was a decrease in mean value of GSR after yogic breathing for experimental group as compared to control group. Joshi, Kiran and Sah (2016)^a results highlight that the mean GSR gets reduced for the group which practised yogic breathing.

Therefore, undergoing deep breathing observed through GSR meter is effective in reducing stress.

4.4.2 Monitoring Stress Level under stimuli of Musical Religious Hymns

The related hypotheses are:

H_9 : There is a significant difference in the mean GSR Value of control group (not exposed to listening to musical religious hymns) at $t=$ zero second and at $t=300$ seconds.

H_{10} : There is a significant difference in mean GSR value of experimental group (exposed to listening musical religious hymns) at $t=$ zero second and $t=300$ seconds.

H_{11} : There is a significant difference in mean GSR value of control group (not exposed to listening to musical religious hymns) and experimental group (exposed to listening to musical religious hymns) at $t =$ zero second.

H_{12} : There is a significant difference in mean GSR value of control group (not exposed to listening to musical religious hymns) and experimental group (exposed to listening to musical religious hymns) at $t =300$ seconds.

The results of the study have been discussed in this section for the control and experimental group. t-test has been used for studying the differences.

Table 4.4.2.1 : Results of t-test Analysis for Religious Hymns (different time interval)

t-Test: Two Sample for Means	Control Group (No Treatment)		Experimental Group (Listening to Hymns)	
	t = 0 second (Pre)	t = 300 seconds (Post)	t = 0 second (Pre)	t = 300 seconds (Post)
Mean	63.58	68.69	69.39	62.61
Known Variance	199.41	208.99	250.28	299.54
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-11.97		19.35	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Table 4.4.2.2 : Results of t-test Analysis for Religious Hymns (same time interval)

t-Test: Two Sample for Means	Control Group	Experimental Group	Control Group	Experimental Group
	t = 0 second (Pre)	t = 0 second (Pre)	t = 300 seconds (Post)	t = 300 seconds (Post)
Mean	63.58	69.39	68.69	62.61
Known Variance	199.41	250.28	208.99	299.54
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-8.18		8.51	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Control Group

As highlighted through Table 4.4.2.1, the mean GSR value of control group recorded through meter is 63.58 (pre) and 68.69 (post) with a variance of 199.41 and 208.99. The value of t-Statistics is 11.97 and is greater than value of t-Critical two-tail (2.60) and p value ≤ 0.01 . So the hypothesis H_9 : there is significant difference in the mean GSR value of control group at t = zero second and t=300 seconds has been accepted. The increase in mean GSR value from 63.58 (t = zero second) to 68.69 (t = 300 seconds) was observed for control group.

Experimental Group

The subjects chosen for this group were those who reported high stress levels. As reflected through Table 4.4.2.1 the mean value of GSR is 69.39 at t=0 second. The subjects were made to listen to hymns and the mean value of GSR is 62.61 at t=300 seconds. The variance recorded is 250.28 and 299.54 respectively for pre and post. The value of t-Statistics is 19.35, which is greater than t Critical two-tail (2.60), and p value ≤ 0.01 .

Thus, hypothesis H_{10} : there is a significant difference in mean GSR value of experimental group (listening to hymns) at t=zero second and t=300 seconds has also been accepted. Thus, it can be inferred that there is a significant reduction in the mean GSR after listening to hymns. The results highlight that the experimental group experienced lower levels of GSR after listening to hymns. In contrast to results of

control group, (where the mean GSR registered an increase, from pre testing to post testing results), in this case the mean value decreased from 69.39 (t=zero second) to 62.61 (t = 300 seconds) reflecting a decrease in GSR for experimental group. Table 4.4.2.2 shows the comparison in the mean GSR between control group at t = zero second and experimental group at t=zero second. The mean value of GSR = 63.58 for the control group at t = zero second and for experimental group at t = zero second, the mean value of GSR is 69.39 with a variance of 199.41 and 250.27 respectively. The result highlights that the value of t Stat = 8.18 is greater than t Critical two-tail (2.60) and p value ≤ 0.01 . Thus, there is a significant difference in the GSR reading. Mean GSR is higher for Experimental group at t=zero second.

Therefore hypothesis H₁₁: there is a significant difference in mean GSR value of control group and experimental group at t = zero second, is accepted.

It can be seen from Table 4.4.2.2 that the Mean value of GSR = 68.69 for the Control Group at t = 300 seconds and for experimental group at t = 300 seconds Mean value of GSR = 62.61 with a variance of 208.99 and 299.54 respectively. As shown through Table 4.4.2.2 the Mean Value control (68.69) is greater than value of Mean Value Experimental (62.61) at t = 300 seconds. Also t Stat = 8.51 is greater than value of t Critical two-tail (2.6), p value ≤ 0.01 . Thus, the hypothesis H₁₂: there is a significant difference in mean GSR values of control group and experimental group at t=300 seconds has also been accepted. Thus, there is a significant difference in the mean GSR. But, in this case, the mean value decreased from 68.69 (t = 300 seconds) to 62.61 (t = 300 seconds). This shows that mean GSR decreased for experimental group at t = 300 seconds as compared to control group at t=300 seconds.

Discussion

Hence in this study the authors used listening to hymns (as stimuli) and GSR meter to monitor effects of hymns on the GSR. The GSR analysis under various stimuli, have been proved by many researchers. Salam (2013) explained GSR, a well-known somatic useful tool, which can be used to monitor objective bodily response during music experience. Music listening is suggestive to combat with stress for to improve health. Wiand (2006) found that the benefits of music reach beyond psychological difficulties into areas experienced as greater perceptions of interconnectedness on a multitude of

levels, which may be described as including expanded states of perceptions or expanded states of awareness. Thoma *et al.* (2013) indicated that music listening hits psychobiological stress system. These investigations are quite helpful to understand the magical effects created by music on the human body and mind. So through this experimental analysis, it has been proved that, GSR technique with listening to hymns can be recommended as an effective technique for monitoring and controlling stress. Joshi , Kiran and Sah (2016)^b demonstrated that the mean GSR gets abridged for the group which listened to Religious Hymns.

4.4.3 Monitoring Stress Level under stimuli of Flute Music

The related hypotheses are:

H₁₃ : There is a significant difference in the mean GSR Value of control group (not exposed to listening to flute music) at t=zero second and at t=300 seconds.

H₁₄ : There is a significant difference in mean GSR value of experimental group (exposed to listening flute music) at t=zero second and t=300 seconds.

H₁₅ : There is a significant difference in mean GSR value of control group (not exposed to listening to flute music) and experimental group (exposed to listening to flute music) at t = zero second.

H₁₆ : There is a significant difference in mean GSR value of control group (not exposed to listening to flute music) and experimental group (exposed to listening to flute music) at t =300 seconds.

The results of the study have been discussed in this section for the control and experimental group. t-test has been used for studying the differences.

**Table 4.4.3.1 : Results of t-test Analysis for Instrumental Classical Music (Flute)
(different time interval)**

t-Test: Two Sample for Means	Control Group (No Treatment)		Experimental Group (Listening to Flute Music)	
	t = 0 second (Pre)	t = 300 seconds (Post)	t = 0 second (Pre)	t = 300 seconds (Post)
Mean	63.58	68.69	70.23	62.49
Known Variance	199.41	208.99	209.43	276.59
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-11.97		18.47	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

**Table 4.4.3.2 : Results of t-test Analysis for Instrumental Classical Music (Flute)
(same time interval)**

t-Test: Two Sample for Means	Control Group	Experimental Group	Control Group	Experimental Group
	t = 0 second (Pre)	t = 0 second (Pre)	t = 300 seconds (Post)	t = 300 seconds (Post)
Mean	63.58	70.23	68.69	62.49
Known Variance	199.41	209.43	208.99	276.59
Observations	199	199	199	199
Hypothesized Mean Difference	0	0	0	
t Stat	-12.44		10.46	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Control Group

As reflected from Table 4.4.3.1, the Mean value of GSR= 63.58 (pre) without Listening to Flute Music and the Mean value of GSR= 68.69 (post) without Listening to Flute Music with a variance of 199.41 and 208.99 respectively. Also t Stat = 11.97, is greater than value of t Critical two-tail (2.6). The p value (two tail) is less than 0.01 (significance level). So Hypothesis H_{13} is accepted. Thus, there is significance difference in the GSR without Listening to Flute Music (pre and post).

But here mean value is increased from 63.58 ($t = \text{zero second}$) to 68.69 ($t = 300 \text{ seconds}$) which shows that mean GSR (post) is increased for control group.

Experimental Group

It can be noticed from Table 4.4.3.1 that the Mean value of GSR = 70.23 before Listening to Flute Music and the Mean value of GSR = 62.49 after Listening to Flute Music with a variance of 209.43 and 276.59 respectively. Value of $t \text{ Stat} = 18.47$ is greater than value of $t \text{ Critical two-tail} (2.60)$. The $p \text{ value (two tail)}$ is less than 0.01 (significance level). So Hypothesis H_{14} is accepted. Thus, there is significant difference in the GSR (pre and post), while Listening to Flute Music. But here mean value decreased from 70.23 ($t = \text{zero second}$) to 62.49 ($t = 300 \text{ seconds}$) which shows that GSR (post) is decreased for Experimental Group.

Table 4.4.3.2 shows the comparison in the mean GSR value, between control group (at $t = \text{zero second}$) and experimental group (at $t = \text{zero second}$). The mean value of GSR = 63.58 for the Control Group at $t = \text{zero second}$ and for experimental group at $t = \text{zero second}$, mean value of GSR = 70.23 with a variance of 199.41 and 209.43 respectively. As shown through Statistical Analysis the Mean Value for control group (63.58) is less than Mean Value for Experimental group (70.23) at $t = \text{zero second}$. The value of $t_{\text{stat}} = 12.44$ is greater than value of $t \text{ Critical two-tail} (2.60)$. The $p \text{ value (two tail)}$ is less than 0.01 (significance level). So Hypothesis H_{15} is accepted. Thus, there is significant difference in the GSR. But here mean value is increased from 63.58 ($t = \text{zero second}$) to 70.23 ($t = \text{zero second}$) which shows that GSR is increased for Experimental group at $t = \text{zero second}$ as compared to Control Group at $t = \text{zero second}$. After that the comparison in the mean GSR Value, between control group at $t = 300 \text{ seconds}$ and experimental group (at $t = 300 \text{ seconds}$), after Listening to Flute Music was done. As shown through Table 4.4.3.2 the Mean Value control (68.69) is greater than value of Mean Value Experimental (62.49) at $t = 300 \text{ seconds}$. Also $t \text{ Stat} = 10.46$ is greater than value of $t \text{ Critical two-tail} (2.6)$. The $p \text{ value (two tail)}$ is less than 0.01 (significance level). Hypothesis H_{16} is accepted. Thus, there is significant difference in the mean GSR. But here mean GSR value is decreased from 68.69 ($t = 300 \text{ seconds}$) to 62.49 ($t = 300 \text{ seconds}$) which shows that GSR is decreased for Experimental group at $t = 300 \text{ seconds}$ as compared to Control Group at $t = 300 \text{ seconds}$.

Discussion

Hence in this study the authors used classical music listening (as stimulus) and GSR meter to monitor effects of Listening to Flute Music on the GSR. The GSR analysis under various stimulus, have been proved by many researchers. Salam (2013) explained GSR, a well-known somatic marker, may be useful in monitoring objective bodily response during music experience. Wiech & Tracey (2009) discovered that emotional experience is the subject psychophysics. The sensory processes in behaviour plays an important role. Obrist (1963) concluded that the amount of the skin resistance difference was significantly condensed in the subjects during stimulation. Researchers Brown (1967) and Villarejo et al. (2012) have reported that GSR is further a function of stress. It yields a continuous measure that is related to activity in the sympathetic branch of the ANS. (Figner & Murphy, 2010). Music listening has played a significant role to minimize stress and improve the mental health. Wiand et al (2006) found that the benefits of flute music reach beyond psychological difficulties into areas experienced as greater perceptions of interconnectedness on a multitude of levels, which may be described as including expanded states of perceptions or expanded states of awareness. Thoma et al. (2013) discovered that music listening creates positive effect on the psychobiological stress system. It predominately targets the autonomic nervous system and enhances the recovery and weak effect on the endocrine and psychological stress response. These observations help to understand magic effects of music on the human body. So in this experimental analysis it has been proved that Listening to Flute Music can be recommended as effective distressing technique.

4.4.4 Monitoring Stress Level under stimuli of Saxophone Music

The related hypotheses are:

H₁₇ : There is a significant difference in the mean GSR Value of control group (not exposed to listening to saxophone music) at t=zero second and at t=300 seconds.

H₁₈: There is a significant difference in the mean GSR Value of experimental group (exposed to listening saxophone music) at t=zero second and at t=300 seconds.

H_{19} : There is a significant difference in mean GSR value of control group (not exposed to listening to saxophone music) and experimental group (exposed to listening to saxophone music) at $t = \text{zero second}$.

H_{20} : There is a significant difference in mean GSR value of control group (not exposed to listening to saxophone music) and experimental group (exposed to listening to saxophone music) at $t = 300 \text{ seconds}$.

The results of the study have been discussed in this section for the control and experimental group. t-test has been used for studying the differences.

Table 4.4.4.1 : Results of t-test Analysis for Instrumental Western Music (Saxophone) (different time interval)

t-Test: Two Sample for Means	Control Group (No Treatment)		Experimental Group (Listening to Saxophone Music)	
	t = 0 second (Pre)	t = 300 seconds (Post)	t = 0 second (Pre)	t = 300 seconds (Post)
Mean	63.58	68.69	69.98	63.38
Known Variance	199.41	208.99	249.61	302.15
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-11.97		16.59	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Table 4.4.4.2 : Results of t-test Analysis for Instrumental Western Music (Saxophone) (same time interval)

t-Test: Two Sample for Means	Control Group	Experimental Group	Experimental Group	Experimental Group
	t = 0 second (Pre)	t = 0 second (Pre)	t = 300 seconds (Post)	t = 300 seconds (Post)
Mean	63.58	69.98	68.69	63.38
Known Variance	199.41	249.61	208.99	302.15
Observations	199	199	199	199
Hypothesized Mean Difference	0		0	
t Stat	-9.20		7.57	
P(T<=t) two-tail	≤ 0.001		≤ 0.001	
t Critical two-tail	2.60		2.60	

Control Group

It can be seen from Table 4.4.4.1 that the mean value of GSR is 63.58 before (without listening to Saxophone music) and the mean value of GSR is 68.69 after (without listening to Saxophone music) with a variance of 199.41 and 208.99 respectively.

As shown through statistical analysis in Table 4.4.4.1, t-Stat 11.97 is greater than t critical (2.60) and p-value is less than 0.01. Thus, alternative hypothesis H_{17} is accepted.

Thus, there is a significance difference in the mean GSR for control group, which is not exposed to saxophone music (before and after). In this case the mean value is increased from 63.58 (t = Zero seconds) to 68.69 (t = 300 seconds) which shows that mean GSR has increased for control group.

Experimental Group

Results for the experimental group, as can be seen from Table 4.4.4.1, the mean value of GSR is 69.98 before the listening to Saxophone music and it is 63.38 after being exposed to Saxophone music with a variance of 249.61 and 302.15 respectively. As shown, the mean value before (69.98) and is greater than mean value after (63.38).

The value of t-Stat is 16.59 and is greater than t-Critical (2.6) and p-value is significant. Thus, based on these results alternative hypothesis H_{18} is accepted.

Thus, there is a significant difference in the GSR for experimental group exposed to listening to Saxophone music. In this case the mean value decreased from 69.98 (t = Zero second) to 63.38 (t = 300 seconds) reflecting a decrease in GSR for experimental group. The comparison in the GSR Basal value, between control group (at t = zero second) and experimental group (at t = zero second) at starting level, is represented through Table 4.4.4.2. The mean value of GSR is 63.58 for the control group at t = zero second and experimental group at t=zero second, mean value of GSR is 69.98 with a variance of 199.41 and 249.61 respectively. As shown the mean value of control group (63.58) is less than Mean value Experimental (69.98) at t = zero second t-Stat is 9.20 and it is greater than t-Critical (2.6) and p-value is less than 0.01, hence, alternative hypothesis H_{19} is accepted. Thus, there is a significant difference in the mean GSR. But here mean GSR value increased from 63.58 (t = zero second) to 69.98(t = zero second) which shows that GSR increased for Experimental group at t = zero second as compared to Control Group at t = zero second. After that the comparison in the mean GSR value, between control group at t = 300 seconds and experimental group at t = 300 seconds, after listening to Saxophone music was done statistically. It can be seen from Table 4.4.4.2 that the mean value of GSR = 68.69 for the Control Group at t = 300 seconds and the mean value of GSR = 63.38 for experimental group at t = 300 seconds with a variance of 208.99 and 302.15 respectively. As shown in Table 4.4.4.2 the mean value of control (68.69) is greater than mean value of experimental (63.38) at t = 300 seconds. As the t-Stat (7.57) is greater than t-critical (2.60) and p-value is significant, thus alternative hypothesis H_{20} is accepted. Thus, there is a significant difference in the mean GSR. But here mean GSR value has decreased from 68.69 for experimental group to 63.38 for control group at t= 300 seconds.

Discussion

The observation of the present study are in concordance with a study conducted by Khalfa *et al.* (2003). They found the decreased level in salivary cortisol in 24 students before and after Trier social stress test when they were subjected to listen relaxing music. Supportive evidence can be garnered from studies conducted by Miluk-Kolasa *et al.*, (1996). Knight & Rickard (2001) went through an interesting study. They put

intentionally a group of undergraduate students to stress to by asking them to prepare for an oral presentation. They found that the sub group which was exposed to music, did not show any significant increase in anxiety, heart rate and blood pressure.

Here this study shows that saxophone music played significant role to overcome stress.

Hence the objective O3: To Monitor Stress Level using Digital Electronic Instrument (GSR meter) through various Stimuli under studies was achieved.

4.5 Identification of most effective Stimuli for Stress Management

The last objective of research was:

O4: To find out the most effective Stimuli under studies of Handling Stress of Engineering Students.

Table 4.5.1 : Mean GSR Value (Pre and Post) for Control and Experimental Groups for all stimuli

S No.	Type of Stimulus	Mean GSR value (siemen)	t = 0 second (Pre Value)	t = 300 seconds (Post Value)	Difference in Mean GSR values
1.	No Drill: Control Group	Mean Value for Control Group	63.58	68.69	+5.11
2.	Undergoing Yogic Breathing	Mean Value for Experimental Group	71.14	63.95	-7.19
3.	Listening to Musical Hymns	Mean Value for Experimental Group	69.39	62.61	-6.78
4.	Listening to Flute Music	Mean Value for Experimental Group	70.23	62.49	-7.74
5.	Listening to Saxophone Music	Mean Value for Experimental Group	69.98	63.38	- 6.6

Table 4.5.1 shows the related data. The mean GSR value was 63.58 (at t = zero) for control group and 69.98 (at t = zero second) for experimental group. Then at t = 300 seconds, it is 63.38 for experimental group and 68.69 for control group. This also signifies that stress level increased for control group, but diminished for experimental group. This supports that stress increased for control group and decreased for experimental group. Clearly the difference in the values is highest for listening to flute -

7.74 followed by undertaking yogic breathing - 7.19. The graphical analysis is shown in figure 4.5.

The effective Stimuli for managing stress of Engineering Students was listening to flute, followed by yogic breathing.

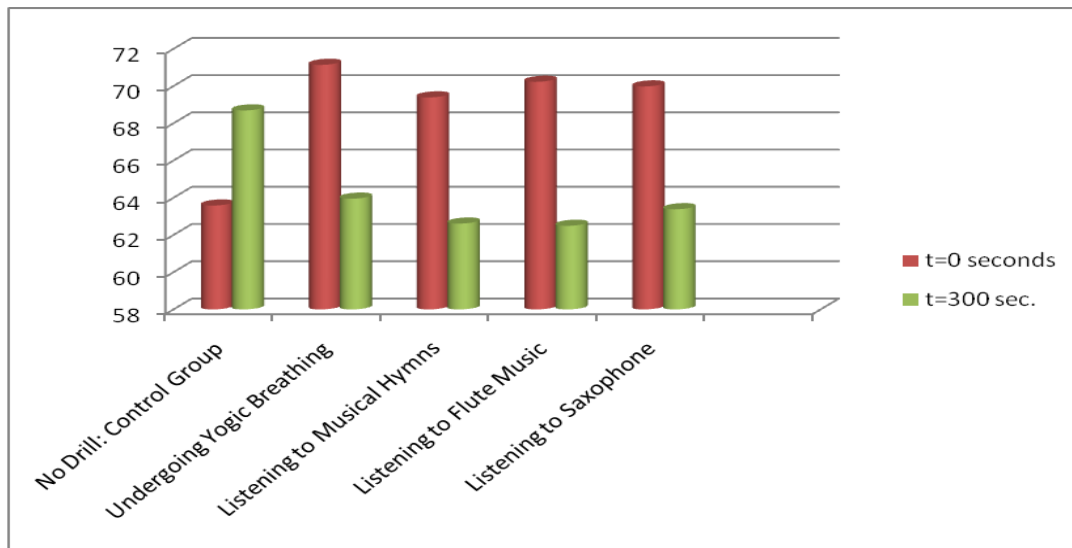


Figure 4.5 : Effect of various stimuli on GSR readings

Hence this objective O4 : To find out the most effective Stimuli under studies of Handling Stress of Engineering Students was achieved.

4.6 Summing Up

This chapter presented the detailed analysis of secondary data as well as data collected through the responses from respondents regarding the factors of gender, age, engineering streams and nature of universities influencing Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies. Factors affecting Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies have been analyzed. There are 34 components of Academic Stress, 15 components of Personal Stress, 7 components of Financial Stress and 19 components of Stress Relieving Strategies.

These were identified with the help of factor analysis that how these components get effected by gender, age, engineering streams and nature of universities. ANOVA was performed to study whether there is a significant difference in the factors of gender, age,

engineering streams and nature of universities influencing Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies. For analyzing inter group differences based on age, engineering streams post hoc Tukey was performed.

The study indicates that there is a significant difference in the Academic Stress, Personal Stress and Stress Relieving Strategies with respect to the different engineering streams, Also there is significant difference in the Financial Stress with respect to the different gender groups. It was found that the mean GSR value decreases under the stimuli of Yogic breathing, Musical Religious hymns, Flute Music and Saxophone Music.

CHAPTER-5

CONCLUSION

Section 5.1 of this chapter squashes the major findings of the research study. Section 5.2 envelops the revisiting of the objectives to find out whether the objectives have been achieved effectively by the research. Section 5.3 points to the limitations of the study; Section 5.4 and 5.5 wraps Significance and Implications of the study respectively. The final section 5.6 explicates the future scope of the research.

5.1 Major Findings of the Study

ANOVA was performed to study whether there is a significant difference in the factors influencing stress based on gender, age, engineering streams and nature of university. The three types of stress considered for the study include: Academic Stress, Personal Stress, Financial Stress. Further, difference of perception was also accorded for Stress Relieving Strategies. For analyzing inter-group differences based on age, engineering streams post hoc Tukey was performed.

The study indicates that there is a significant difference in the factors influencing Academic Stress, Personal Stress, Financial Stress and Stress Relieving Strategies based on different streams of engineering. There is also a significant difference in case of the factors of Financial Stress and Stress Relieving Strategies based on the gender. Also there is a significant difference in case of the factors of Financial Stress and Academic Stress based on the nature of university.

In the current study, the results as shown in table 4.4.1.1 reflected that Yogic Breathing had a significant effect on GSR (as it was found to be reduced extensively for students who undertook yogic breathing exercise). The GSR was recorded through GSR sensor meter, a non-invasive device. In the control group GSR readings were found to be increased, as these students were not exposed to yogic-breathing technique. The mean basal value was low 63.58 (at $t = \text{zero}$) for control group, where as it was high 71.14 (at $t = \text{zero}$) for experimental group. Then at $t = 300$ seconds it was found that it decreased (63.95) for experimental group and increased for control group (68.69). This also signifies that stress (in terms of GSR) increased for control group, but decreased for the

experimental group. Hence, it proves the significance of application of GSR meter as a bio-Feed Back Sensor in our routine life especially for the students. So during student life, this practice may boost a student's efficiency and the critical issue of managing stress by using this simple technique of yogic breathing. This practice can help in enhancing productivity and also in reducing stress also.

In the table 4.4.2.1 the statistical analyses reflects, that listening to Musical Religious Hymns has a significant effect on the GSR (as it was found to be reduced extensively) using GSR meter. The mean GSR value was 63.58 (at t = zero) for control group and 69.39 (at t = zero) for experimental group. Then at t = 300 seconds the mean GSR value got decreased from 68.69 to 62.61 for experimental group.

The statistical analysis replicates, that Saxophone Music has a significant effect on the mean GSR of experimental group (as it was found to be reduced extensively) using GSR meter, where as for control group GSR was too affected but here it reflected an increase. As per the analysis in table 4.4.3.1, Listening to Flute Music has a significant effect on the GSR (as it was found to be reduced extensively) using GSR sensor meter where as for control group it was observed that without Listening to Flute Music, GSR was found to be increased. The mean basal value was low 63.58 (at t = zero) for control group, where as it was found to be increased to 70.23 (at t = zero) for experimental group. Then at t = 300 seconds it is decreased (62.49) for experimental group and increased for control group (68.69). This also signifies that stress (in terms of GSR) got increased for control group, but decreased for experimental group.

Table 4.4.4.1 shows the data for Saxophone Music. The mean basal value was 63.58 (at t = zero) for control group and 69.98 (at t = zero) for experimental group. Then at t = 300 seconds, it is 63.38 for experimental group and 68.69 for control group. This also signifies that GSR (stress level) increased for control group, but reduced for experimental group. This supports that GSR (stress) increased for control group and decreased for experimental group.

5.2 Revisiting the Objectives

It is necessary to revisit the research objectives to see whether the study has been able to accomplish the same.

The first objective of the present research has been:

O1: To identify the factors leading to Stress in Engineering Students of a Government University (Punjabi University, Patiala) and Private University (Thapar University, Patiala)

Stress factors questionnaire used in the present study has been based on four variables.

It consisted of 75 items describing the stress information from their institution/personal life as well as from the other various sources. There were 75 questions. The bifurcation of the questions was Stress Relieving Strategy (19), Personal Stress (15), Financial Stress (7) and Academic Stress (34).

Academic Stress was compared based on gender, age, engineering streams and nature of university.

The results of factor analysis as shown through Table 4.2.1.1 which highlights that based on factor analysis seven factors emerged. These seven factors explained 51.126 % of variation.

ANOVA results through table 4.2.1.2 reflect that there is a significant difference in perception of respondents in one of the seven factors influencing academic stress based on gender groups (male and female) considered for analysis to reject hypothesis H_{1a} .

ANOVA results through Table 4.2.1.3 and 4.2.1.4 showed that there is a significant difference in the academic stress with respect to the different age groups to reject hypothesis H_{1b}

ANOVA results through Table 4.2.1.5 and 4.2.1.6 reflect that there is a significant difference in perception of respondents in four of the seven factors influencing academic stress based on engineering streams considered for analysis. Thus, the hypothesis H_{1c} : there is a significant difference in the academic stress with respect to the different engineering stream groups has been partially accepted.

ANOVA results (table 4.2.1.7) reflect that there is a significant difference in perception of respondents in three of the seven factors influencing academic stress based on nature of university groups considered for analysis. Thus, the hypothesis H_{1d} : there is a

significant difference in the academic stress with respect to the nature of university groups have been partially accepted.

Personal Stress was also compared based on gender, age, engineering streams and nature of university.

The results of factor analysis as shown through Table 4.2.2.1, highlight that based on factor analysis seven factors emerged. These four factors explained 55.743 % of variation.

ANOVA results (table 4.2.2.2) reflect that there is significant difference in perception of respondents in one of the four factors influencing personal stress based on gender groups considered for analysis to reject hypothesis H_{2a} .

ANOVA results (table 4.2.2.3 and 4.2.2.4) reflect that there is a significant difference in one of the four factors influencing personal stress based on age groups considered for analysis. So the hypothesis H_{2b} : there is a significant difference in the personal stress with respect to the different age groups has been rejected.

ANOVA results (table 4.2.2.5 and 4.2.2.6) reflect that there is a significant difference in three of the four factors influencing personal stress based on engineering stream groups considered for analysis to accept hypothesis H_{2c} .

ANOVA results (table 4.2.2.7) reflect that there is no significant difference in perception of respondents in any of the four factors influencing personal stress based on university groups considered for analysis to reject hypothesis H_{2d} .

Financial Stress too was compared based on gender, age, engineering streams and nature of university.

The results of factor analysis as shown through Table 4.2.3.1 which highlight that based on factor analysis two factors emerged. These two factors explained 58.693 % of variation.

ANOVA results (table 4.2.3.2) reflect that there is significant difference in perception of respondents in both the two factors influencing financial stress based on gender groups considered for analysis to accept the hypothesis H_{3a} .

ANOVA results as shown in table 4.2.3.3 and 4.2.3.4 reflect that there is no significant difference in any of the two factors influencing financial stress based on age groups considered for analysis to reject hypothesis H_{3b} .

ANOVA results as per table 4.2.3.5 and 4.2.3.6 reflect that there is a significant difference in the perception of respondents in one of the two factors influencing financial stress based on engineering streams considered for analysis to partially accept the hypothesis H_{3c} .

ANOVA results (table 4.2.3.7) reflect that there is significant difference in perception of respondents in one of the two factors influencing financial stress based on university groups considered for analysis to partially accept the hypothesis H_{3d} .

Stress Relieving Strategies too were compared based on gender, age, engineering streams and nature of university. The results of factor analysis as shown through Table 4.2.4.1, highlight that based on factor analysis five factors emerged. These five factors explained 51.119 % of variation.

As shown in the table 4.2.4.2, ANOVA results reflect that there is no significant difference in perception of respondents in three of the five factors to partially accept hypothesis H_{4a} .

As indicated in table 4.2.4.3 and 4.2.4.4, ANOVA results reflect that there is no significant difference in any of the five factors influencing Stress Relieving Strategies based on age groups considered for analysis. Thus, the hypothesis H_{4b} : there is a significant difference in the Stress Relieving Strategies with respect to the different age groups has been rejected.

The table 4.2.4.5 and 4.2.4.6 projects the ANOVA results and shows there is a significant difference in perception of respondents in three of the five factors influencing stress relieving strategy based on engineering streams considered for analysis to partially accept the hypothesis H_{4c} .

ANOVA results (table 4.2.4.7) reflect that there is no significant difference in perception of respondents in any of the five factors influencing Stress Relieving Strategies based on university groups considered for analysis to reject the hypothesis H_{4d} .

Hence this objective O1: To identify the factors leading to Stress in Engineering Students of a Government University (Punjabi University, Patiala) and Private University (Thapar University, Patiala) was achieved.

O2: To measure stress through GSR (Skin Conductance) to identify students with high stress level.

The experimental group had revealed high willingness for yogic breathing exercise and other Musical drills and they wished to get their GSR level monitored through GSR sensor meter.

In Table 4.5.1 Mean GSR Value (pre) for Experimental Groups for all stimuli is shown. Hence this objective was achieved through the students of experimental group at t=0 second.

Hence this objective O2: To measure stress through GSR (Skin Conductance) to identify students with high stress level was achieved.

O3: To Monitor Stress Level using Digital Electronic Instrument (GSR meter) through various Stimuli under studies.

As shown in table 4.4.1.1 there is a significance difference in the GSR value of control group not exposed to yogic breathing (pre and post). In fact here the mean value increased from 63.58 (t = zero seconds) to 68.69 (t = 300 seconds) which shows increase in GSR (post) for control group.

There is a significant difference in the GSR for pre and post session for the experimental group exposed to yogic breathing. However, importantly, the mean value decreased from 71.14 (t = Zero second) to 63.95 (t = 300 seconds).

Also, the results as shown through Table 4.4.2.1 highlight that the experimental group experienced lower levels of GSR after listening to musical religious hymns. In contrast to results of control group, (where the mean registered an increase, from pre testing to post testing results of GSR), in this case the mean value decreased from 69.39 (t=Zero second) to 62.61(t = 300 seconds) reflecting a decrease in GSR for experimental group.

Table 4.4.3.1 shows there is significance difference in the GSR without Listening to Flute Music (pre and post). But here mean value is increased from 63.58 (t = zero second) to 68.69 (t = 300 seconds) which shows that GSR(post) is increased for control group.

There is significant difference in the GSR (pre and post), while Listening to Flute Music. But here mean value decreased from 70.23 (t = Zero second) to 62.49 (t = 300 seconds) which shows that GSR (post) is decreased for Experimental Group.

Table 4.4.4.1 projects there is a significance difference in the GSR for control group, which is not exposed to saxophone music (before and after). In this case the mean value is increased from 63.58 (t = Zero second) to 68.69 (t = 300 seconds) which shows that GSR has increased for control group. There is a significant difference in the GSR for experimental group exposed to listen to Saxophone music. In this case the mean value decreased from 69.98 (t = Zero second) to 63.38 (t = 300 seconds) reflecting a decrease in GSR for experimental group.

Hence this objective O3 : To Monitor Stress Level using Digital Electronic Instrument (GSR meter) through various Stimuli under studies was achieved.

O4: To find out the most effective Stimuli under studies of Handling Stress of Engineering Students.

Table 4.5.1 shows the appealing data. The mean GSR value was increased for control group (with no drill) where as for experimental group (with any drill of music or yogic breathing) it was reduced. This signifies that stress level increased for control group, but reduced for experimental group. This supports that stress in terms of mean GSR increased for control group and decreased for experimental group.

Clearly the difference in the values is highest for Listening to Flute Music -7.74 followed by Undergoing Yogic Breathing - 7.19. The graphical analysis is shown in figure 4.5.

Hence this objective O4 the most effective Stimuli under studies of Handling Stress of Engineering Students was achieved.

5.3 Limitations of the study

Like any research study, the present study also has some limitations. One limitation is that of the time of experimentation. The participants' subjective feedback at t=300 seconds would have added more inputs and deepened the analysis. Further, this study can be extended and repeated experimentation may be performed. This would help in finding out whether participants' GSR levels are usually reduced by the four stimuli included in the study. This is an initial attempt and results are encouraging. Repeated experiments will also help in finding out how long do the lowered GSR levels remain. In addition to GSR (skin conductivity), the other physiological parameters like Breathing

Rate, Pulse Rate and Blood Pressure could also be included for analysis. It is time to think intensely about managing and controlling students' stress as it is leading to depression and tackling it, is an urgent concern.

5.4 Significance of the Study

The study used a recommended GSR technology and recommends its usage to examine the levels of stress in engineering students. The study can be extended to use various other stress management techniques and measuring GSR to understand for deeper analysis. The other physiological parameters like respiration rate, pulse rate and blood pressure can also be tested in addition to GSR. It is time to think intensely about managing and controlling stress as it is deep-rooted malaise and tackling it, is the immediate concern.

The research through Bio Medical Instruments i.e. GSR bio feedback meter and BP monitor can be facilitated to improve the relaxation power of the students in a constructive manner. Consultancy can be generated from Educational Institutes as well as the Corporate's to train their man power through this module. Overall efficiency of the students will improve. This Endeavour may help in plummeting bad habits like drug addiction, smoking and drinking. Their physical and mental health will improve. Such type of work can be conducted on Human Resources of corporate sectors as well as the educational institutions and revenue can be generated.

As engineering students have to work in industries, so for better quality of life free from stress and improved employability skills, such innovative activities should be developed to ascertain the sustainable academic's abilities of students. To control the outcome of stress properly, there are certain precautions and methods that should be taken that will boost productivity. This may boost the efficiency of students and assist in dealing with the critical issue of suicides and many other crimes, thus contributing to healthy social system.

5.5 Implications of the study

Academic Stress can severally hinder academic performance as well as adjustment in life in several ways. The suggested research will help to reduce stress, improve efficiency and productivity of the engineering students. This attempt may help in plummeting bad habits that emerge from stress like drug addiction, smoking and drinking. Their physical and mental health will improve. This study can be extended to students of other colleges and public enterprises. The study will also be extremely useful for students of Medical and para-medical sciences. The suggested techniques can be adopted as for managing stress in all educational institutions.

5.6 Further Scope of Research

Based on the above findings, it is proposed that techniques like undergoing deep breathing, listening to musical religious hymns, flute music and saxophone music can be adopted as a strategy to manage stress in educational institutions.

Adopting these in their routine life will reduce the chances of stress and will also help in reducing stress levels in students suffering from stress. The authors suggest that the bio-feedback practice of GSR meter need to be adopted in for students who are under stress and they be exposed to such exercises as per their choice.

In fact, the developed world is also moving to adopting yoga and musical therapies. This will facilitate healthy and efficient student life and this practice in educational institutions may result in saving precious lives of the youth indulging in taking extreme step of committing suicide. The healthy engineering student population can then contribute to their personal growth, and contribute positively to Industrial growth. Further studies on larger samples may be obligatory to improve the generalizability of the results. Resorting to such simple stress coping strategies may lead to healthy and efficient student life and may be due to this practice a few precious lives of the youth may be saved in educational institutions and the society also has the advantage of possessing healthy future generation.

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STRESS SCALE

This scale consists of 75 items describing the stress in your institution/ college /personal life from the various sources. The level of stress you feel for each item can be indicated by marking a tick mark (✓).

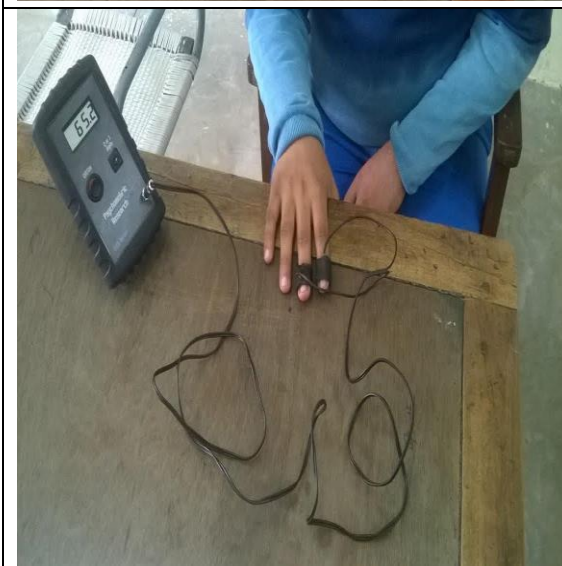
S. No.	Kindly rate the following factors causing stress from 1 -5 in the order of priority with 1 being least and 5 as highest	1	2	3	4	5
Academic Stress Questions (1-34)						
1.	Lack of interest in some subjects	1	2	3	4	5
2.	Lack of concentration during study hours	1	2	3	4	5
3.	Difficulty in memorizing and retention of lectures	1	2	3	4	5
4.	Overload of Assignments	1	2	3	4	5
5.	Callous attitude of teachers	1	2	3	4	5
6.	Personal hesitation to ask questions in class	1	2	3	4	5
7.	Inadequate query handling by teacher	1	2	3	4	5
8.	Inadequate space / room for studying at home	1	2	3	4	5
9.	Lack of confidence in the class	1	2	3	4	5
10.	Lack of opportunity to meet teachers	1	2	3	4	5
11.	Slow in getting along with the curriculum	1	2	3	4	5
12.	Unable to complete the assignment in time	1	2	3	4	5
13.	Monotonous teaching style by the teacher	1	2	3	4	5
14.	Lack of case studies to support teaching and learning	1	2	3	4	5
15.	Lack of interactive sessions in class	1	2	3	4	5
16.	Exam papers are tough	1	2	3	4	5
17.	Examination syllabus is too heavy in some subjects	1	2	3	4	5
18.	Worrying about the examinations	1	2	3	4	5

19.	Concern about results after examinations	1	2	3	4	5
20.	Tendency to 'day-dream' when trying to study	1	2	3	4	5
21.	Study periods are often too short for me to get 'warmed up' and concentrated	1	2	3	4	5
22.	Missing important points while taking notes in class	1	2	3	4	5
23.	Too tired, sleepy and listless to study efficiently	1	2	3	4	5
24.	Enjoyment of loafing (spending time ideally), 'bull- seasons' (amusing and illogical use of words) interferes with my study	1	2	3	4	5
25.	Dislike of certain courses and teachers interferes With getting good results	1	2	3	4	5
26.	Unable to discuss Academic failures with parents	1	2	3	4	5
27.	Not able to grasp the subject matter	1	2	3	4	5
28.	Inadequate subject knowledge of the teachers	1	2	3	4	5
29.	Inadequate lab space	1	2	3	4	5
30.	Inadequate Library facilities	1	2	3	4	5
31.	Less placement opportunity provided by the institute	1	2	3	4	5
32.	Fear of appearing in the placement activities	1	2	3	4	5
33.	Fear of Failure in job selection interviews	1	2	3	4	5
34.	Unfavorable Location of placement	1	2	3	4	5
	Personal Stress Questions (35-49)	1	2	3	4	5
35.	Lack of self-confidence	1	2	3	4	5
36.	Lack of fluency while speaking the language other than the mother tongue	1	2	3	4	5
37.	Difficulty in public speaking	1	2	3	4	5
38.	Time is unwisely distributed; spending too much	1	2	3	4	5

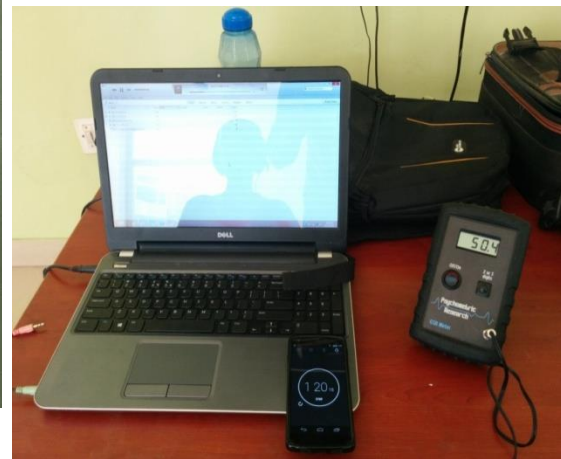
	time on something leaving inadequate time for other tasks					
39.	Over learning and working beyond the point of immediate memory or recall	1	2	3	4	5
40.	Getting excited very easily	1	2	3	4	5
41.	Unable to take strong decisions	1	2	3	4	5
42.	Feeling of inferiority	1	2	3	4	5
43.	Difficulty in adjusting with opposite gender	1	2	3	4	5
44.	Unnecessarily worrying about my responsibilities	1	2	3	4	5
45.	Unable to fully utilize my abilities in performing my different duties	1	2	3	4	5
46.	I feel that this world is a place good enough for passing life	1	2	3	4	5
47.	Unduly imaginary calamities	1	2	3	4	5
48.	Too perplexed (puzzled or confused) with my contradictory thoughts	1	2	3	4	5
49.	Too anxious about my future	1	2	3	4	5
	Financial Stress Questions (50-56)	1	2	3	4	5
50.	Low family income					
51.	Burden of interest on bank loans	1	2	3	4	5
52.	High fees of institute	1	2	3	4	5
53.	Feel the need of the job due to family financial crisis	1	2	3	4	5
54.	High Expenses of books and study material	1	2	3	4	5
55.	Identity crisis due to the strong financial conditions of peers	1	2	3	4	5
56.	Low package	1	2	3	4	5
	Stress Relieving Strategy Questions (57-75)	1	2	3	4	5
57.	Eat, Smoke or chew gum	1	2	3	4	5

58.	Look at the problem objectively	1	2	3	4	5	
59.	Seek comfort and help from family and friends	1	2	3	4	5	
60.	Think through different ways to handle the situation	1	2	3	4	5	
61.	Accept the situation as it is	1	2	3	4	5	
62.	Day dream, fantasize	1	2	3	4	5	
63.	Blame someone else for your problems	1	2	3	4	5	
64.	Practice meditation and yoga as stress relievers	1	2	3	4	5	
65.	Let someone else solve the problem	1	2	3	4	5	
66.	Drink alcoholic beverages	1	2	3	4	5	
67.	My friends / relatives remain ready to help me in the difficult times	1	2	3	4	5	
68.	Resign yourself to the situation because things look hopeless	1	2	3	4	5	
69.	Share with someone who has faced similar situation	1	2	3	4	5	
70.	Go to sleep, figuring things will look better in the morning	1	2	3	4	5	
71.	Withdraw from the situation	1	2	3	4	5	
72.	Release tension with physical activity.	1	2	3	4	5	
73.	Possess capacity to mould myself according to the circumstances	1	2	3	4	5	
74.	Listen to music to release tension	1	2	3	4	5	
75.	Resort to prayers and religious mantras to release tension						

Pictures of Experimental Testing



GSR Meter with laptop and
Stop
Watch



Control Group Subjects with GSR Meter attached (not exposed to any of the Drills)



Experimental Group Subjects with GSR Meter attached (exposed to the Drills of Deep Breathing and Listening to Music)

Appendix III

List of Publications

S. No.	Title of the Paper	Journal Name & Vol. No. Status	Authors Name
1	An Experimental Analysis To Monitor And Manage Stress Among Engineering Students Using Galvanic Skin Response Meter	WORK: A Journal of Prevention, Assessment and Rehabilitation 56(3) 409-420. 2017	Anurag Joshi Ravi Kiran AN Sah
2	Stress Monitoring Through Non-Invasive Instrumental Analysis Of Skin Conductivity	WORK: A Journal of Prevention, Assessment and Rehabilitation 57(2) 233-243. 2017	Anurag Joshi Ravi Kiran AN Sah
3	Stress management through regulation of blood pressure among college students	WORK: A Journal of Prevention, Assessment & Rehabilitation, 54(3) 745-752. 2016	Anurag Joshi Ravi Kiran HK Singla AN Sah

**WORK (Listed in SSCI- Thomson Reuters List) Impact factor (2017) 0.779*

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WORK celebrates its 25th anniversary in 2015.

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