ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Bachelor of Technology
(Biomedical Engineering)

(Effective for the students admitted from the Academic Year 2014-15)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
Department of Biomedical Engineering (B.Tech)
GR14 Regulations

Gokaraju Rangaraju Institute of Engineering & Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Biomedical Engineering with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is B.Tech in Biomedical Engineering, a four-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the B.Tech in Biomedical Engineering Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the Government/University or on the basis of any other order of merit approved by the Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. **Programme Pattern:**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 200.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of B.Tech Degree:** A student will be declared eligible for the award of B.Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of B.Tech degree, if he/she pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.
   b) A student has to register for all 200 credits and secure all credits.
   c) A student, who fails to fulfill all the academic requirements for the award of the degree within eight academic years from the date of admission, shall forfeit his/her seat in B.Tech course.

d) The degree of B.Tech in Biomedical Engineering shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements:

a) A student shall be eligible to appear for the semester-end examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above but less than 75%) in a semester may be granted. A committee headed by Dean, Academic Affairs shall be the deciding authority for granting the condonation.
c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.
d) Shortage of Attendance more than 10% (attendance less than 65% in aggregate) shall in no case be condoned.
e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment:

a) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council from time to time.
b) Distribution and Weightage of Marks
c) Continuous Internal Evaluation and Semester End Examinations
The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end

S.No.		End exams (External)	Internal	Total
1	Theory	70	30	100
2	Practical	50	25	75
3	Engineering Graphics	70	30	100
4	Industry Mini Project	50	25	75
5	Comprehensive Viva	100	-	100
6	Seminar	-	50	50
7	Project	150	50	200

examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	30	Internal Exams & Continuous Evaluation	1) Two mid semester examinations shall be conducted for 20 marks each for duration of 2 hours. Average of the two mid exams shall be considered i) Subjective - 15 marks ii) Objective - 5 marks 2) Tutorials - 5 marks 3) Attendance - 5 marks
		70	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	25	Internal Exams & Continuous Evaluation	1) Lab Internal :10 marks 2) Record : 5 marks 3) Continuous Assessment : 5 marks 4) Attendance : 5 marks
		50	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) Industry Oriented Mini Project: The Mini Project is to be taken up with relevance to Industry and is evaluated for 75 marks. Out of 75, 25 marks are for internal evaluation and 50 marks are for external evaluation. The supervisor continuously assesses the student for 15 marks (Attendance – 5 marks, Continuous Assessment – 5 marks, Report – 5 marks). At the

end of the semester, Mini Projects shall be displayed in the road show at the department level for the benefit of all students and staff and the same is to be evaluated by the Mini Project Review Committee for 10 marks. The Mini Project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for 50 marks.
Mini Project Review Committee consists of HOD, Mini Project Coordinator and Supervisor.

e) **Comprehensive Viva:** The Comprehensive Viva shall be conducted by a Committee consisting of HOD and two senior faculty members of the department. The student shall be assessed for his/her understanding of various courses studied during the programme of study. The Viva-Voce shall be evaluated for 100 marks.

f) **Seminar:** For the seminar, the student shall collect information on a specialized topic and prepare a technical report and present the same to a Committee consisting of HOD, two senior faculty and the seminar coordinator of the department. The student shall be assessed for his/her understanding of the topic, its application and its relation with various courses studied during the programme of study for 50 marks.

g) **Major Project:** The project work is evaluated for 200 marks. Out of 200, 50 marks shall be for internal evaluation and 150 marks for the external evaluation. The supervisor assesses the student for 25 marks (Attendance – 5 marks, Continuous Assessment – 15 marks, Report – 5 marks). At the end of the semester, Projects shall be displayed in the road show at the department level for the benefit of all the students and staff and the same is to be evaluated by the Project Review Committee for 25marks. The external evaluation for Project Work is a Viva-Voce examination which is conducted by the Project Review Committee in the presence of external examiner and is evaluated for 150 marks.
Project Review Committee consists of HOD, Project Coordinator and Supervisor.

h) **Engineering Graphics**
- Two internal examinations, each is of 20 marks .The average of the two internal tests shall be considered for the award of marks.
- Submission of day to day work - 5 marks.
- Attendance - 5 marks.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**
    a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she securesnot less than 35% of marks in the Semester-end Examination and a minimum of 40% of the sum total of the Internal Evaluation and Semester-end examination taken together.
    b) A student shall be promoted from II year to III year; or from III year to IV year only if he/she fulfills the academic requirements of minimum credits from the following examinations whether the candidate takes the examination or not.

Phase	Minimum Credits	No. of Examinations				
		I-I	I-II	II-I	II-II	III-I
II to III Year	37	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular —	--- ---	--- —
III to IV Year	62	3 Regular 2 Supply	2 Regular 2 Supply	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular

13. Award of Class: After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by Jawaharlal Nehru Technological University Hyderabad, he/she shall be placed in one of the following four classes (the marks awarded are from the aggregate marks secured for the 200 credits):

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%
Pass Class	40% ≤ Marks < 50%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of Students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-admission/re-registration to the same or equivalent subjects as and when they are offered.

17. **General Rules**
    a) The academic regulations should be read as a whole for the purpose of any interpretation.
    b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
    c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
    d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

Academic Regulations GR14 for B.Tech (Lateral Entry)

(Effective for the students admitted into II year from the Academic Year 2015-16)

1. All regulations as applicable for B.Tech Four year degree programme (Regular) will hold good for B.Tech. (Lateral Entry Scheme) except for the following rules:

a) Pursued a programme of study for not less than three academic years and not more than six academic years(para2(a))

b) Registered for 150 credits and secured 150 credits. The marks obtained in all 150 credits shall be considered for the calculation of the final percentage of marks (para2(b))

c) Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech programme (para2(c))

2. Academic Requirements

A student shall be promoted from III year to IV year only if he/she fulfills the academic requirement of minimum credits from the following examinations whether the candidate takes the examination or not (para 12(b)).

Phase	Minimum Credits	No. of Examinations		
		II-I	II-II	III-I
III to IV Year	37	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular —

3. Award of Degree or Class

After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by Jawaharlal Nehru Technological University Hyderabad, he/she shall be placed in one of the following four classes (the marks awarded are from the aggregate marks secured for the 150 credits):

Class Awarded	% of Marks Secured
First class with Distinction	Marks ≥ 70%
First class	60% ≤ Marks < 70%
Second class	50% ≤ Marks < 60%
Pass class	40% ≤ Marks < 50%

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.Tech (BME) PROGRAMME STRUCTURE

I B.Tech (BME) — I Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
BS	GR14A1001	Linear Algebra and Single Variable Calculus	2	1	-	3	4	100
BS	GR14A1002	Advanced Calculus	2	1	-	3	4	100
BS	GR14A1007	Engineering Physics	2	1	-	3	4	100
HS	GR14A1005	English	2	1	-	3	4	100
ES	GR14A1009	Computer Programming	2	1	-	3	4	100
ES	GR14A1019	Fundamentals of Electronics Engineering	3	1	-	4	5	100
ES	GR14A1025	Engineering Workshop	-	-	2	2	4	75
BS	GR14A1029	Engineering Physics lab	-	-	2	2	4	75
ES	GR14A1027	Computer Programming lab	-	-	2	2	4	75
		Total	**13**	**6**	**6**	**25**	**37**	**825**

I B.Tech (BME) — II Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
BS	GR14A1003	Transform Calculus and Fourier Series	2	1	-	3	4	100
BS	GR14A1004	Numerical Methods	2	1	-	3	4	100
BS	GR14A1008	Engineering Chemistry	2	1	-	3	4	100
ES	GR14A1010	Data Structures	2	1	-	3	4	100
ES	GR14A1023	Engineering Graphics	1	-	2	3	5	100
ES	GR14A1018	Basic Electical Engineering	3	1	-	4	5	100
HS	GR14A1024	Business Communication and Soft Skills	-	-	2	2	4	75
ES	GR14A1026	IT Workshop	-	-	2	2	4	75
BS	GR14A1030	Engineering Chemistry lab	-	-	2	2	4	75
		Total	**12**	**5**	**8**	**25**	**38**	**825**

II B.Tech (BME) — I Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
PC	GR14A2050	Probability Theory and Stochastic Processes	3	1	-	4	5	100
PC	GR14A2043	Digital Electronics	3	1	-	4	5	100
PC	GR14A2049	Signals and Systems	3	1	-	4	5	100
PC	GR14A2080	Bio-Electricity	2	1	-	3	5	100
PC	GR14A2081	Applied Chemistry	3	1	-	4	5	100
PC	GR14A2082	Medical Sciences Lab	-	-	2	2	4	75
PC	GR14A2053	DIgital Electronics Lab	-	-	2	2	4	75
PC	GR14A2052	Signals & Systems Lab	-	-	2	2	4	75
		Total	**-**	**-**	**-**	**25**	**36**	**725**
MC	GR14A2001	Environmental Science	4	-	-	-	4	100
		Total	**18**	**5**	**6**	**25**	**40**	**825**

II B.Tech (BME) — II Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
PC	GR14A2083	Basic Clinical Sciences	3	1	-	4	5	100
PC	GR14A2086	Analog Integrated Electronics	3	1	-	4	5	100
PC	GR14A2104	Managerial Economics and Financial Analysis	2	1	-	3	4	100
PC	GR14A2084	Medical Imaging Techniques	3	1	-	4	5	100
PC	GR14A2085	Bio Transducers and Applications	3	1	-	4	5	100
PC	GR14A2087	Transducer Applications Lab			2	2	4	75
PC	GR14A2088	Medical Imaging Techni-Ques Laboratory	-	-	2	2	4	75
PC	GR14A2061	Analog Electronics Lab			2	2	4	75
		Total	**-**	**-**	**-**	**25**	**36**	**725**
MC	GR14A2002	Value Education and Ethics	4		-	0	4	75
		Total	**18**	**5**	**6**	**25**	**40**	**825**

III B.Tech (BME) — I Semester

Group	Subject	L	T	P	Credits	Hours	Marks
PC	Digital Signal Processing	3	1	-	4	5	100
PC	Biomedical Equipment	3	1	-	4	5	100
PC	Micro Controllers	3	1	-	4	5	100
PC	Principles of Communication	3	1	-	4	5	100
PC	General Surgery and Radiology	2	1	-	3	4	100
PC	Advanced English Communication Skills Lab	-	-	2	2	4	75
PC	Biomedical Equipment Lab	-	-	2	2	4	75
BS	Micro Controllers Lab	-	-	2	2	4	75
	Total	**14**	**5**	**6**	**25**	**36**	**725**

III B.Tech (BME) — II Semester

Group	Subject	L	T	P	Credits	Hours	Marks
PC	Biomedical Signal Processing	3	1	-	4	5	100
PC	VLSI Design	3	1	-	4	5	100
PC	Bio-Fluids and Mechanics	3	1	-	4	5	100
PC	Lasers in Fiber Optics and Medicine	2	1	-	3	4	100
	Open Elective	3	1	-	4	5	100
PE	Biological Control Systems						
	Reliability Engineering						
	Telemedicine						
PC	Biomedical Signal Processing Lab	-	-	2	2	4	75
PC	VLSI Design Lab	-	-	2	2	4	75
SPW	Industry Oriented Mini Project	-	-	2	2	4	75
	Total	**14**	**5**	**6**	**25**	**36**	**725**

IV B.Tech (BME) — I Semester

Group	Subject	L	T	P	Credits	Hours	Marks
PC	Artificial Neural Networks	3	1	-	4	5	100
PC	Rehabilitation Engineering	2	1	-	3	4	100
PC	Embedded Systems	3	1	-	4	5	100
	Elective - I	3	1	-	4	5	100
PE	Computer Networks						
	Operating Systems						
	Robotics and Automation						
	Elective - II	3	1	-	4	5	100
PE	Biomaterials						
	Transport Phenomenon in Living Systems						
	Electromagnetic Interference and Compatibility						
PC	Virtual Bio-Instrumentation Lab	-	-	2	2	4	75
PC	Advanced Communication Systems Lab	-	-	2	2	4	75
PC	Embedded Systems Lab	-	-	2	2	4	75
	Total	**14**	**5**	**6**	**25**	**36**	**725**

IV B.Tech (BME) — II Semester

Group	Subject	L	T	P	Credits	Hours	Marks
PC	Medical Image Processing	2	1	-	3	4	100
	Elective - III	2	1	-	3	4	100
PE	Bio MEMS						
	Physiological Systems Management						
	Hospital Systems Management						
	Elective - IV	2	1	-	3	4	100
PE	Intellectual Property Rights						
	Quantitative Engineering Physiology						
	Medical Informatics						
PC	Medical Image Processing Lab	-	-	2	2	4	75
SPW	Seminar	-	-	2	2	4	50
SPW	Comprehensive Viva	-	-	2	2	4	100
SPW	Major Project	-	-	10	12	12	200
	Total	**6**	**3**	**16**	**24**	**36**	**725**

I - Year