

Faculty of Dentistry



JSS Academy of Higher Education & Research

(Deemed to be University)

Accredited "A" Grade by NAAC

Sri Shivarathreeshwara Nagar, Mysuru – 570 015

Regulation & Syllabus

DIPLOMA IN DENTAL MECHATRONICS

2017

Diploma

Diploma in Dental Mechatronics Program

REGULATIONS

These regulations shall be called as “The Regulations for the **Diploma in Dental Mechatronics** course of the JSS University, Mysuru”. They shall come into force from the Academic Year 2017 – 2018. The regulations framed are subject to modifications from time to time by the Academic Council.

DIPLOMAIN DENTALMECHATRONICS

Minimum qualification for admission to **Diploma in Dental Mechatronics** course — A pass in any of the following examinations.

1. 10 + 2 examination with Physics as a subject from a recognized Board or University (50% is not compulsory)
2. ITI
3. Diploma
4. Any other qualification approved by the recognized Board or University as equivalent to any of the above examination.
5. The candidate should be at least 17 years old

Provided that there shall be reservation of seats for Scheduled Caste and Scheduled Tribes candidates in accordance with the instructions issued by the Central Govt. /State Govts/Union Territory Admns. as the case may be from time to time]

Duration of the program: The duration of the course shall be for one academic year spread over a period of not less than two hundred and twenty working days with 110 hours of theory, 330 hours of practicals and 220 clinicals. Besides, in addition to this, course will have 660 hours internship training spread over a period of not less than 6 months. The curricula and syllabi for the course shall be prescribed from time to time.

Medium of Instruction and examination: Medium of instruction and examination shall be in English.

Course of study - The course of study for Diploma in Dental Mechatronics and the number of hours devoted to each subject for its teaching in theory and practical are given in Table I.

TABLE –I

SI No	Subjects	No. of hours (Theory)	No of hours (Practicals)
1	Basic Electricals	30 hours	Not Applicable
2	Basic Electronics	30 hours	Not Applicable
3	Dental Mechatronics	50 hours	330 hours

Practicals: Course will have three hours of practical in dental mechatronics each day with minimum of 330 hours spread over first six months.

Clinical hours: Course will have two hours of clinical postings in dental departments each day with minimum of 220 hours spread over first six months.

Internship: Course will have six hours of internship per day with minimum of 660 hours spread over last six months.

Examinations - There shall be an annual examination for Diploma in Dental Mechatronics to examine students of the course at the end of one year. The students failing to pass the examination in all the subjects shall appear for the supplementary examination which may be conducted within 60 days from the declaration of final exam results. The examinations shall be of written and practical (including oral) nature, carrying maximum marks for each part of a subject, as indicated in Table II.

TABLE –II

DIPLOMA IN DENTAL MECHATRONICS FINAL EXAMINATION

Maximum marks for Theory				Maximum marks for Practicals		
Subject	Examination	*Internals	Total	Examination	*Internals	Total
Basic Electricals	70	30	100	No Practical exam		
Basic electronics	70	30	100	No Practical exam		
Dental Mechatronics	70	30	100	70	30	100
Total	210	90	300	70	30	100
Grand Total		300 + 100 = 400				
*Internal assessment.						

Eligibility for appearing at the Diploma in Dental mechatronics examination: Only such candidates who produce certificate from the Head of the Academic institution in which he /she has undergone the Diploma in Dental mechatronics course, in proof of his /her having regularly and satisfactorily undergone the course of study by attending not less than 75% of the classes held in theory, practical and internship separately in each subject shall be eligible for appearing at the Diploma in Dental Mechatronics examination.

Mode of examinations:

- 1) Each theory and practical examination in the subjects mentioned in Table –II shall be of three hours duration.
- 2) A Candidate who fails either in theory or practical examination of a subject shall re-appear in theory or practical in which the candidate has failed.
- 3) Practical examination shall also consist of a viva –voce (Oral) examination.

Award of internal assessment marks and maintenance of records:

- 1) A regular record of both theory and practical class work and examinations conducted in an institution imparting training for diploma in Dental mechatronics course, shall be maintained for each student in the institution and 30 marks for each theory and 30 marks for each practical subject shall be allotted as internal assessment.

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- 2) There shall be at least three periodic internal assessment examinations during the course. The highest aggregate of any two performances shall form the basis of calculating internal assessment marks.
- 1) The internal assessment marks in practicals shall be allotted on the following basis:-
- | | |
|---|----------|
| (i) Actual performance in the internal assessment examination | 20 marks |
| (ii) Day to day assessment in the practical class work | 10 marks |

Minimum marks for passing the examination: A student shall not be declared to have passed Diploma in Dental mechatronics course examination unless he /she secures at least 50% marks in each of the subject separately in the theory examinations, including internal assessment marks and at least 50% marks in each of the practical examinations including internal assessment marks. The candidates securing 60% marks or above in aggregate in all subjects in a single attempt at the Diploma in Dental mechatronics course examinations shall be declared to have passed in first class. Candidates securing 75% marks or above in any subject or subjects shall be declared to have passed with distinction in the subject or those subjects provided he/she passes in all the subjects in a single attempt.

Eligibility for promotion to Diploma in Dental mechatronics course: All candidates who have appeared for all the subjects and passed the Diploma in Dental mechatronics are eligible for the award of Diploma in Dental mechatronics course.

Improvement of internal assessment marks: Candidates who wish to improve internal assessment marks can do so, by appearing in one additional internal assessment examinations during the course. The score of this examination shall be the basis for improved internal assessment marks in theory. The internal assessment of practicals shall be improved by appearing in additional practical examinations. Marks awarded to a candidate for day to day assessment in the practical class cannot be improved unless he /she attend a regular course of study again.

Approval of examinations: The examinations mentioned in regulations shall be held by an authority herein after referred to as the Examining Authority of the College, which shall be approved by the University. Such approval shall be granted only if the Examining Authority concerned fulfills the conditions as specified in examining authority of the University.

Certificate of passing examination for Diploma in Dental mechatronics course: Certificate to having passed the examination for the Diploma in Dental mechatronics shall be granted by the Examining Authority to a successful student.

SYLLABUS

DIPLOMA IN DENTAL MECHATRONICS

BASIC ELECTRICALS

(Theory – 30 hours)

Subject	No. of hours (Theory)	No. of hours (Practicals)
1. Introduction.	1 hour	NA
2. Current Electricity. Introduction, electric current, resistance, laws of resistance, Ohm's law, resistance in series and parallel, Kirchhoff's laws, cell and battery,- internal resistance and electromotive force, cells in series and parallel	5 hours	NA
3. Electrostatics. Static electricity, Coulomb's laws of electrostatics, capacitor and capacitance, capacitors in series and parallel.	5 hours	NA
4. Magnetism and Electromagnetism. Bar magnet, electromagnet, magnetism, sources of magnetism, electromagnetism, right hand rule, magneto motive force, solenoid, solenoid valve	5 hours	NA
5. Electromagnetic Induction. Relation between magnetism and electricity, Faradays laws, inductors and inductance, inductors in series and parallel, self inductance	5 hours	NA
6. Alternating and direct current. Introduction	3 hours	NA
7. Transformer. Principle of operation,,induction law, step-up and step-down	3 hours	NA
8. Electrical spares. Switch, toggle, rotary, foot, push button, electronic, fuse, construction, holders, automotive and thermal fuses, thread seal tape, electrical tape	3 hours	NA
Total	30 hours	NA

NA* - Not applicable

BASIC ELECTRONICS

(Theory - 30 hours)

	Subject	No. of hours (Theory)	No. of hours (Practicals)
1.	Electronics – Introduction. Importance, conductor, Insulator and semiconductor, passive and active components	1 hour	NA*
2.	Passive components. Resistor, Resistance, fixed resistors, variable resistors, colour code, capacitor, types.	3 hours	NA
3.	Semi-conductor Physics. Introduction, Intrinsic and Extrinsic Semiconductor, n- type and p-type Semiconductor, p-n junction, Forward and reverse biased p-n junction, zener and avalanche breakdown.	4 hours	NA
4.	Semi-conductor Diodes. p-n junction or crystal diode, diode as a rectifier, half- wave and full-wave rectifier, nature of rectifier output, filter circuits, zener diode, zener diode as voltage regulator	4 hours	NA
5.	Optoelectronic Devices and fiber optics. Introduction, photoconductive cel, photo diode, phototransistor, solar cells, light emitting diode, fiber optics	3 hours	NA
6.	Transistors. Introduction, n-p-n and p-n-p transistor, transistor terminals, some facts about transistor, transistor as an amplifier	4 hours	NA
7.	Power Electronics, Introduction	2 hours	NA
8.	Digital Electronics Introduction, integrated circuits	2 hours	NA
9.	Piezoelectricity, Introduction	2 hours	NA
1	. Sine Wave Oscillators, Introduction	2 hours	NA
1	. Switched Mode Power Supply (SMPS)	1 hour	NA
1	. Electronic Instruments	2 hours	NA
	Total	30 hours	NA

NA* - Not applicable

DENTAL MECHATRONICS

(Theory - 50 hours) Subject	No. of hours (Theory)	No. of hours (Practicals)
1. Dental Science Introduction, Dentist and Dental Specialists, The Dental Health Care Team	3 hours	No practical
2. Sterilization Techniques Classification of instruments and equipments, Instrument processing area, Sterilization monitoring, Methods of sterilization, Autoclave, Handpiece sterilization	3 hours	21 hours
3. Dental Unit Waterlines 4. Background, Microorganisms in Dental unit water, Biofilm, Biofilm in Dental waterlines, Methods for reducing bacterial contamination, Infection control and dental unit water	3 hours	21 hours
5. The Dental Clinic Office Environment, treatment area, Clinical equipments, Maintenance, Care of dental equipments, Central sterilization, Dental laboratory, Dentist's private office	5 hours	35 hours
6. Dental Hand pieces and Accessories Evolution of rotary equipment, Low-speed handpiece, High-speed handpiece, Hand piece maintenance	5 hours	35 hours
7. Vacuum and Pneumatic techniques Vacuum techniques, Oral evacuation systems, Vacuum pump, Pneumatic techniques, Dental compressor	5 hours	35 hours
8. Dental Radiography Foundation of radiography, Discovery of X-radiation, Radiation physics, The Dental x-ray machine, x-ray production	3 hours	21 hours
9. Digital Radiography Introduction, Basic concepts, Radiation exposure, Equipments	3 hours	21 hours
10. Dental Gadgets Ultrasonic scaler, Dental curing light, Amalgamator, Intraoral camera	15 hours	106 hours
11. Technology of Dental Chair Unit Dental chair system, Lighting system, Trolley or delivery system, Tumbler and spittoon system, spare parts	5 hours	35 hours
Total	50 hours	330 hours

PRACTICAL(330 hours)

The Practical exercises include

1. Identification of various parts in a dental chair.
2. Identification of various tools and equipments.
3. Identification of problems in the dental chair.
4. Assembling various components in a dental chair
5. Repair of various dental equipments
6. Repair of compressor
7. Repair of all electrical and electronic dental equipments
8. Designing of dental clinic set up

Internship: Candidates enrolled for the program should complete an internship of 660 hours spread over a period of six months at a dental chair manufacturing unit recognized by the university.

BOOKS RECOMMENDED (LATEST EDITIONS)

Basic Electricals

1. M L Anwani. Basic Electrical Engineering. Revised edition 2010; Reprint 2012. Dhanpat Rai and Company Private Limited. New Delhi.
2. B. L. Theraja. Fundamentals of Electrical engineering and electronics. First Multi color edition 2006, Reprint 2010. S. Chand and company Limited. Ram Nagar New Delhi.

Basic electronics

1. N N Bhargava, D C Kulshreshtha, S C Gupta. Basic electronics and linear circuits. Technical Education Series. Tata Mc Graw Hill Education private Limited, New Delhi.
2. Theodore F. Bogart, Jr. Electric Circuits. Second edition. Electricity and Electronics Series. Mc Graw Hill International Editions. Illinois, USA.

Dental Mechatronics

1. Harry L Stewart. Hydraulic and Pneumatic power for production. Revised fourth edition 1977. Industrial Press Inc. New York.
2. Dental equipment repair and technology. University of Michigan library, United States of America.
3. Jayachandran. Afundamental study on dental clinic and clinical systems. Theory and Practical Manual.
4. Jayachandran. Dental Mechatronics. Practical Manual.

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SCOPE OF THE COURSE

Combination of electric, electronics, pneumatic and mechanical in order to design and manufacture Dental Products.

The main objective of this training course is to impart technical knowledge to the candidates on design and application in Dental industry.

Foreign Exchange Earning potential: Being for the first Time in the World, we have great potential to attract foreign students for this course.

Two day crash course for Dentists to solve general trouble shoots.

The course equips the candidates to acquire in the application of Dental Equipments as they will be exposed to electrical, electronics, mechanical and pneumatic to develop suitable systems for dental industries (Manufacturing and service sector) for increasing the productivity.

The program presentation is supported with audio-visual aids and working models.

On the job / Shop training in assembling, aligning, testing, servicing, installation and maintenance (preventive and breakdown) of the following dental equipments:

1. Dental Chair
2. Dental Unit (Delivery system, Light system etc.)
3. Dental X-Ray
4. Scalar
5. Light cure
6. Micro-motor
7. Suction-motor
8. Dental Compressor

Shop Floor Training

1. **Safety precaution**

2. **General testing**

Resistors, coils, capacitors, relays, micro switches and transformers.

3. **Inspection**

Stepwise and final inspection procedures and other quality control techniques

4. **Maintenance**

Technical procedure for electric, electronic, mechanical and pneumatic components, testing and replacement of defective components

For example:-a) simple electronic circuit

b) Transformer and coils

c) Preventive Maintenance & AMC

Employment Potential:

Introducing for the first time in the world.

Lack of qualified technicians in this industry.

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- Scarcity of service technicians in Dental companies, Dental Colleges, Dental Hospitals and Dental Clinics in India and overseas.
 - Minimum requirements of 10:1 ratio of Dental doctors to Technicians.
 - According to the statistics, minimum of 2000 technicians are needed per year in India, because approximately 25,000 doctors are graduating in India per year.

Salient Features:

- This is an unorganized sector where there is no formal training except for apprenticeship in some dental chair manufacturing companies.
- This will be the first of its kind in the country where a formal training with internship will be offered. Hence, we may get admissions from India if we send an attractive brochure to all ITI colleges in the country.
- We may attract students from abroad as well (Middle east, Africa etc through NRI linkages)

- The additional dental technical manpower will facilitate in addressing the maintenance problems in dental college
- The initiation of new course will always be a value addition that helps our accreditation process

Examination pattern

Diploma in Dental Mechatronics

Examination pattern

Paper I: Basic Electricals - 70 marks (Theory)

Question paper layout

JSS University

JSS Dental College and Hospital

Diploma in Dental Mechatronics

Paper I: Basic Electricals

Theory Examination

Duration: 3 hours Max marks:70

Section A. Answer any ten (multiple choice questions or fill in the blanks) out of 12.

Section B. Short answers: Answer any ten questions out of 12 10 X 3 marks each = 30 marks

Section C: Answer any four questions out of 6.4 X 5 marks each = 20 marks

Minimum passing marks 50%

Sample Paper

JSS University

JSS Dental College and Hospital

Diploma in Dental Mechatronics

Paper I: Basic Electricals

Duration: 3hrs Max. Marks: 70

SECTION A:

Answer any ten questions (10X2=20 Marks)

1. Electric resistance is similar to----- in mechanics.
2. Unit of resistance is-----.
3. One horsepower = ----- watts.
4. A battery consists of a number of ---.
5. The unit of electric flux is-----.
6. The unit of capacitance is-----.
7. The value of Curie point is-----.
8. An electromagnet formed by wrapping turns around a cylindrical core, is called a-----.
9. One radian is ----.
10. Unit of power is
11. Wave form of ac is -----.
12. When the number of turns in the primary coil is greater than the number of turns in the secondary coil, is called -----transformer.

SECTION B: Short answers

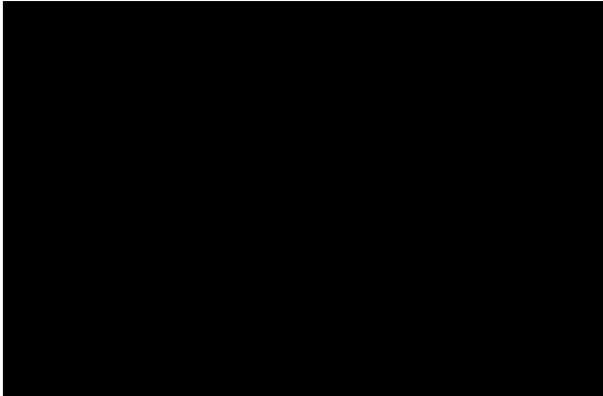
Answer any ten questions (10X3=30 Marks)

1. How much current flows in 80 Ω of resistance when it dissipates 32 mW?
2. Define electromotive force with unit?
3. Explain Ohm's law.
4. A, 75 Ω , 120 Ω and 45 Ω resistors are connected series with a source of 50 V. 1) Find the total equivalent resistance and total current I_T in the circuit. 2) Find also power dissipated in each resistor.
5. How much charge is stored by a 220 pF capacitor when a 50 V source is connected across it?
6. Define fuse?
7. What is magnetic induction?
8. What are applications of solenoid valve?
9. What is Fleming's right hand rule?
10. Define potential difference?
11. What is ac? Explain. Draw electrical symbol of ac.
12. What is a transformer? Explain.

SECTION C: Long answers

Answer any four (4X5=20marks)

1. What is inductors and inductance? What is the unit of inductance?



2. With reference to figure, voltage source 24 V and resistance R is 8 ? .
- Find the current I in the resistance.
 - Find the current when the voltage of the source is doubled.
 - Find the current when the voltage is restored to its original value and the resistance is doubled
3. Explain Coulomb's laws of electrostatics?
4. Explain with diagram Kirchoff's current law?
5. Define switch and thermostat?
6. A 10 μF , a 20 μF and a 40 μF capacitor are connected in series to a 399 volts source of e.m.f.
- What is the equivalent capacitance?
 - What is the magnitude of charge across each capacitor?
 - What is the potential difference across each capacitor?

Diploma in Dental Mechatronics

Paper II – Basic Electronics

Question paper layout

Paper II: Basic Electronics

Theory Examination

Duration: 3 hours Max marks: 70

Section A. Answer any ten (multiple choice questions or fill in the blanks) out of 12. 10 X 2 marks each = 20 marks

Section B. Short answers: Answer any ten questions out of 12 10 X 3 marks each = 30 marks

Section C: Answer any four questions out of 6. 4 X 5 marks each = 20 marks

Minimum passing marks 50%

Diploma in Dental Mechatronics

Paper II: Basic Electronics

Sample Paper

Duration: 3hrs Max. Marks: 70

SECTION A

Answer any ten questions (10×2=20 Marks)

1. A semiconductor has----- temperature co-efficient of resistance
2. The barrier potential voltage for silicon p-n junction is ----.
3. A Zener diode operates in the ----- region
4. A LED consists of a----- biased P-N junction
5. Light emitters convert -----energy into light energy.
6. The colour bands on a fixed carbon resistor are: brown, red, and black (given sequentially). Its value is
 - a) 12 ohm b) 21 ohm c) 120 ohm d) 210 ohm
1. A full-wave bridge rectifier uses ----- diodes.
2. Working of solar cells is based on -----principle.
 - a) Photo detector b) phototransistor c) Photodiode d) photovoltaic
1. The term IC , as used in electronics denotes
 - a) Internal combustion (b) Integrated circuitc) Industrial control d) Indian culture
2. In an SCR, the function of the gate is to
 - a) switch it OFF b) control its firing
 - c) make it unidirectional d) reduce forward breakdown voltage
11. A electronic oscillator
 - a) Needs an external input b) Provides its own output c) Is nothing but an amplifier
 - d) Is just a dc/ac converter
12. The base of transistor is----- doped.

SECTION B: Short answers**Answer any ten questions****10×3=30 Marks**

1. What are passive and active components?
2. What is an inductor? What is the unit of inductance?
3. What is called depletion layer?
4. Draw the symbol of n-p-n and p-n-p transistor and specify the leads.
5. Name the three possible transistor connections.
6. What is a zener diode?
7. Write four applications of SCR
8. What is piezoelectricity?
9. What is an oscillator?
10. Draw block diagram of a SMPS with output voltage regulation.
11. State the various electrical quantities that can be measured with a multimeter.
12. If a resistor is rated at 1000 ohms and 10 Watts. What is the maximum current it can carry?

SECTION C: Long answers

Answer any four questions

4×5=20 Marks

1. What is a p-n junction? Explain the formation of potential barrier in a p-n junction?
2. Describe a half-wave rectifier using a crystal diode.
3. What is a transistor? Why is it so called?
4. Write a brief description about SCR.
5. Zener diode as voltage regulator .Explain
6. Explain light emitting diode(LED) with diagram?

Diploma in Dental Mechatronics

Question paper layout:

Paper III: Dental Mechatronics

Duration: 3 hours

Max marks: 70

Section A. Answer any ten (multiple choice questions or fill in the blanks) out of 12.

10 X 2 marks each = 20 marks

Section B. Short answers: Answer any ten questions out of 12 10 X 3 marks each = 30 marks

Section C: Answer any four questions out of 6. 4 X 5 marks each = 20 marks

Minimum passing marks 50%

Diploma in Dental Mechatronics

Paper III: Dental Mechatronics

Sample Paper
Duration: 3hrs

Max. Marks: 70

SECTION A:

Answer any ten questions

(10×2=20 Marks)

1. is a specialist who installs and maintains dental equipment
2. Instrument for sterilization by means of moist heat under pressure.
3. Place where sterilized instruments, fresh disposable suppliers, and prepared trays are stored.
4. Process that kills all microorganisms
5. In the.....the patient is positioned as if lying down.
6. In the.....the patient's head is lower than the feet.
7. is a section of technology that deals with the study and application of air to produce mechanical motion.
8. A..... converts energy (typically in the form of compressed air) into mechanical motion.
9. A..... is a valve that automatically cuts off the flow of a liquid or gas at a certain pressure.
10. A..... is a form of switch that closes an electrical contact when a certain set pressure has been reached on its input.
11. is the positive electrode in the x-ray tube.
12. is the ability to do the work.

SECTION B: Short answers**Answer any ten questions****10×3=30 Marks**

1. What are four operation cycle in steam sterilizer ?
2. What is dry heat sterilization ?
3. What are two types of dry heat sterilization ?
4. What are three methods for reducing bacterial contamination?
5. How use full Self-contained water reservoirs or water booster?
6. What are the Patient positions in a dental chair
7. What are the three delivery systems in a dental chair?
8. What is the high-volume evacuator (HVE)?
9. Define air compressor?
10. Define solenoid valve?
11. What is frequency and its units?
12. What is ferro-magnetic substance? Give one example.

SECTION C: Long answers**Answer any four questions****4×5=20 Marks**

1. Draw block diagram for water booster system?
2. Define dental ultrasonic scaler? Mention three types of dental scalers.
3. What is a dental light cure unit? Mention four basic type of dental curing light.
4. What is magnetostriction or electrostriction? What material using in magnetostrictive scaler?
5. Draw block diagram of manual dental hydraulic circuit?
6. Define transformer? What transformer using in dental lighting system?

Diploma in Dental Mechatronics

Practical examinations: 50 marks + 20 marks Viva – Voce.

Practical Examination layout:

Duration: 4 hours Max marks 70

A. Record book completion: 10 marks
Spotters: 5 X 2 marks each: 10 marks
One practical exercise

B. Assembly/Repair of dental equipments 30 marks
Viva – Voce: 20 marks
Total Practical's 70 marks

Internal examiner - 01

One staff from Dental Mechatronics

External examiner: - 01

A staff from electrical or electronics department of JSS Polytechnic with minimum 2 year teaching experience preferably among the faculty involved in teaching for Dental Mechatronics programme

Dental surgeon – 01 (Chief Coordinator) – can be a senior faculty from JSS Dental College.

Remuneration for examiners is as per University norms.

Valuation of theory paper is undertaken by Internal and External examiners.

Average of the marks allotted by internal and external examiners will be used to compute the marks in theory and practicals.