SYLLABUS

Saurashtra University

DDU Kaushal Kendra
Curriculum for
BACHELOR of VOCATION
in
RADIATION & IMAGING TECHNOLOGY

(Under UGC – DDU Kaushal Kendra sanctioned to Shree Manibhai Virani & Smt. Navalben Virani Science College-Rajkot)

(Sanction Letter No. 3-43/2015(KAUSHAL) dated 14.08.2015)

B.Voc. - Radiation & Imaging Technology

Semester I

Credit Based Semester System (CBSS)
Effective from June 2015-16

Bachelor of Vocation – Radiation & Imaging Technology

(3 years – Six Semester Full Time Course)

DEEN DAYAL UPADHYAY KAUSHAL KENDRAs

(XII plan guidelines for Deen Dayal Upadhyay Centres for knowledge acquisition and upgradation of skilled human abilities and livelihood (KAUSHAL) in universities and colleges -2014 - 2017)

Introduction:

Education plays an important role in the overall development of a human being as well as the nation. It is a unique investment in the present and for the future. Every country develops its own system of education to express and promote its unique socio-cultural identity besides meeting the challenges of time to leverage the existing potential opportunities. India, at present, is recognized as one of the youngest nations of the world with over 50% of population under the age of 30 years. It is estimated that by 2025, India will have 25% of the world's total workforce. In order to harness the full demographic dividend, India needs high quality educational system which is affordable, flexible and relevant to the individuals, as well as to needs of the society as a whole. Today, the country faces a demand – supply mismatch as the economy needs more 'skilled' workforce as also the managers and entrepreneurs than produced annually. In fact, majority of the contemporary institutions of higher learning remain almost disconnected with the requirements of the workplace. The higher education system has to incorporate the requirements of various industries in its curriculum, in an innovative and flexible manner while producing well groomed graduates. UGC introduced two schemes known as – Community Colleges and B.Voc. Degree Program in universities and colleges during the XII Plan. However, there is a need for taking integrated initiatives towards knowledge acquisition and up-gradation of skilled human competencies in universities and colleges to address the emerging needs of the economy so as to ensure that the graduates have adequate knowledge and skills to get appropriately employed or become entrepreneurs and, thereby, meet the economic and industrial needs at the regional and national level. Government of India, taking note of the requirement for skill development among students developed National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this, the UGC implemented the scheme of Community Colleges from 2013-14 in pilot mode on the initiative of the MHRD. However, realizing the importance and the necessity for developing skills among students, and creating work ready manpower on large scale, the Commission decided to implement the scheme of Community Colleges as one of its independent schemes from the year 2014-15. The Commission also launched another scheme of B.Voc. Degree program to expand the

scope of vocational education and also to provide vertical mobility to the students admitted into Community Colleges for Diploma programs to a degree program in the Universities and Colleges. While these two schemes are being implemented, it is also realized that there is a need to give further push to vocational education on a even larger scale. It is therefore proposed to establish as many as 100 'Deen Dayal Upadhyay Centres for Knowledge Acquisition and Up gradation of Skilled Human Abilities and Livelihood (KAUSHAL)' during the XII Plan period. These Centers would take-up the vocational education to new levels and offer courses beyond B.Voc. degree also. These Centres would also embed and follow the guiding principles of NSQF, QPs, and NOSs for their programs and would not focus on skilling alone but also develop entrepreneurship traits. The Centres may endeavor to maintain a pyramidical structure of student enrolment with respect to Diploma, Advanced Diploma, B.Voc. and further studies.

Objectives of the Scheme:

The main objectives of these centers are to:

a) create skilled manpower for industry requirements at various levels. The scheme provides for vertical mobility from short term certificate courses to full-fledged post graduate degree program, and further research in specialized areas. The courses would be planned/ designed to have provision of multiple entry and exit at various levels culminating up-to a research degree level. These shall also include courses which are offered under the Community College Scheme and B.Voc. degree program of UGC.

b) Formulate courses at postgraduate level keeping in mind the need of i) Industry in specialized areas; ii) Instructional design, curriculum design and contents in the areas of Skills Development; iii) Pedagogy, assessment for skills development education and training; iv) trained faculty in the areas of skill development; and v) Entrepreneurship; etc.

c) work for coordination between the higher education system and industry to become a Centre of Excellence for skill development in specialized areas.

d) network with other such centers and universities and colleges imparting vocational education under the scheme of Community Colleges and B.Voc degree program in their region and coordinate with them for targeted development of skill oriented education.

e) undertake R&D in the areas related to skill education & development, entrepreneurship, employability, labour market trends etc. at the post-graduate and research level.

f) act as finishing school by providing supplementary modular training programs so that a learner, irrespective of his/her training background, is made job ready with necessary work skills (soft, communication, ICT skills etc) and fill the gaps in the domain skills measured against QPs/NOSs.

g) provide for Recognition of Prior Learning (RPL) framework for job roles at NSQF Level 4 onwards by conducting assessment and certification with respective Sector Skill Councils (SSCs) / Directorate General of Employment and Training (DGET).

h) Maintain 'Labour Market Information' for respective regions in coordination with other government agencies and industry associations.
i) develop and aggregate curriculum, content and learning materials for skills development in different sectors.

Basic Principles for Curriculum Design:

While formulating the curriculum under the scheme, the Centers may:

a) follow credit based semester system;
b) provide for provision for credit transfer across courses;
c) ensure alignment of skill component with the QPs/NOSs of the relevant job roles based on the exit profiles of the students. The focus of skill development components should be to equip students with appropriate knowledge, practice and attitude, so as to make them work ready. The skill development components should be relevant to the industries as per their requirements;
d) provide credits for practical work, apprenticeship, on the job training, and project work;
e) provide multiple exit and entry points with provision for vertical and horizontal mobility;
f) assess and certify the skill competence for the selected job roles through the respective SSCs / DGET;
g) provide credits for general education component and skill component broadly in the ratio of 40 : 60. The general education will also include credits in communication skills, ICT skills, soft skills, critical thinking, problem solving, environmental studies and value education.
h) review the courses periodically in accordance with the changing requirements of the industry and regional / national economic priorities.
i) follow UGC guidelines for skill development courses at different levels specified under Community Colleges, B.Voc. degree program and as may be prescribed from time to time.

Programs and Curricula: (UGC guidelines for curricular aspects, assessment criteria and credit system in skill based vocational courses under national skills qualification framework (NSQF))

In order to make education relevant and to create 'industry fit' skilled workforce, the institutions recognized under Community Colleges / B.Voc Degree program, and Deen Dayal Upadhyay KAUSHAL Kendras offering skill based courses will have to be in constant dialogue with the industry and respective Sector Skill Council(s) so that they remain updated on the requirements of the workforce for the local economy. There will be credit-based modular programs, wherein banking of credits for skill and general education components shall be permitted so as to enable multiple exit and entry. This would enable the learner to seek employment after any level of Award and join back as and when feasible to upgrade her / his qualification / skill

competency either to move higher in her / his job or in the higher educational system. This will also provide the learner an opportunity for vertical mobility to second year of B.Voc degree program after one year diploma and to third year of B.Voc degree program after a two year advanced diploma. The students may further move to masters and research degree programs (NSQF Level 8 – 10)

Degree of Bachelor of Vocation in Radiation & Imaging Technology (B.Voc. – Radiation & Imaging Technology) Degree Course

Ordinance, Regulations and Examination Scheme :

O.S. B.Voc.- R & I Tech.– 1 :

Admission Eligibility: There may be three types of learners getting admission to first semester of skill based courses under NSQF:

Category – 1 : students already acquired NSQF certification Level 4 in a particular industry sector and opted admission in the skill based courses under NSQF in the institutions recognized under Community Colleges / B.Voc Degree program / DDU KAUSHAL Kendras in same trade with job role for which he / she was previously certified at school level.

Category – 2 : students who have acquired NSQF certification Level 4 but may like to change their trade and may enter into skill based courses in a different trade.

Category – 3 : students passed 10+2 examination with conventional schooling without any background of vocational training.

Candidate who have passed an equivalent examination from any other board or examining body and is seeking admission to the Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) course will be required to provide necessary eligibility certificate.

Lateral Entry :
Candidate seeking admission directly in third semester of Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) must have passed Examination of either Diploma in Engineering or Diploma in Pharmacy **OR** B.Sc./BE/B.Voc. first year (candidate has to take up Skill Bridge course- Theory & Practical during semester 3) from any UGC recognized University.

O.S. B.Voc.- R & I Tech.– 2 :
The duration of the course will be of three full time academic years. No candidate will be allowed to join any other course or service simultaneously. The examination for the Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) course will be divided into six semesters.

Multi-level Exit :
Candidate will be eligible to receive Diploma(NSQF Level 5) after first 2 semesters and Advance Diploma (NSQF Level 6) after 4 semesters according to guidelines of UGC.

O.S. B.Voc.- R & I Tech.– 3 ::

Subject to the provisions laid down in Ordinance O.S. B.Voc.- **R & I Tech.–** 2, a candidate who has passed the B. Voc. semester I & II/ B. Voc. semester III & IV of this University and if there is a break in the studies for any reason and if there is a change in the courses from semester system to annual part Examination system, the candidate will be admitted to B.Voc. Part II / B.Voc. Part III and the marks/ credits obtained by the candidate in his previous examination of this University in B.Voc. semester I and II will be carried forward and the result of the B.Voc. Second/ Final Examination will be declared accordingly.

O.S. B.Voc.- R & I Tech. – 4 :
No candidate will be admitted to any semester examination for Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) unless a student has put on at least 80% of the total lecture periods and practical periods in each subject in each semester.

O.S. B.Voc.- R & I Tech. – 5 :
No candidate will be permitted to reappear at any semester examination, which he has already passed. The marks of successfully completed paper will be carrying forwarded for the award of class.

O.S. B.Voc.- R & I Tech. – 6 :
There shall be an examination at the end of each semester to be known as Pre Diploma (first semester) examination, Diploma (second semester-NSQF Level-5) examination, Pre Advanced Diploma (third semester) examination, Advanced Diploma (forth semester-NSQF Level-6) examination, Pre B.Voc. Degree (fifth semester) examination and B.Voc. Degree (sixth semester-NSQF Level-7) examination. At which a student shall appear in that portion of theory papers, practical and viva – voice if any, for which he has kept the semester in accordance with the regulations in this behalf.

A candidate whose term is not granted for what so ever reason shall be required to keep attendance for that semester or term when the relevant papers are actually taken at the college.

O.S. B.Voc.- R & I Tech. – 7 :
Guidelines to keep term of B.Voc. R & I Tech.)
A candidate will be permitted to continue his/her study up to the 4^{th} semester examination without passing his/her previous semester examination.

A candidate can take admission to fifth (pre-ultimate) semester if he/she is failing in NOT more then two subjects of previous (1 to 4) semesters.

A candidate can take admission to Sixth (Ultimate/Final) Semester if he/she is not failing in more then two subjects of 5^{th} Semester. Provided he/she should have cleared all 1 to 4 semester.

R.S. B.Voc.- R & I Tech.

Standard of Passing

The standard of passing for Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) degree examination will be as under :

1) To pass any semester examination of the Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) degree, a candidate must obtain at least 40% marks in the University examination separately in each course of theory and practical.

2) Total marks of each theory paper are 100 (External examination 70 marks + Internal examination 30 marks)

3) No internal examination marks in practical and project-viva papers.

4) Total marks of Entrepreneurship Development & Soft skill Training is 100. This subject will be evaluated either orally &/or practically on the basis of Project report submitted by the student.

5) Those of the successful candidates who obtain 50% or more marks in the aggregate of all the semester taken together will be placed in the Second class and those who obtain 60% or more marks in the aggregate of all the semester taken together will be placed in the First class. The successful candidates who obtain 70% or more marks in the aggregate of all the semester taken together will be declared to have passed the examination in the First class with Distinction.

6) A result of candidate who have obtained admission directly in Bachelor of Vocation – Radiation & Imaging Technology (B.Voc.- R & I Tech.) semester – III will be declared by considering his marks of semester III to VI in aggregate and accordingly class will be awarded as per normal percentage of marks fixed for other candidate.

B.Voc. Radiation & Imaging Technology

Name of the Program(s) (Diploma, Adv. Diploma, Degree)	Semesters	No. of Credits **30 Cr./Sem**	Job Roles and **NSQF**-Levels
Diploma in **X-Ray Technician**	1	60 Credits	**NSQF Level 5** Supervisor
	2		
Advance Diploma in **Ultra Sound Imaging**	3	60 Credits	**NSQF Level 6** Technician / Trainer
	4		
B.Voc. in **Radiation & Imaging Technology**	5	60 Credits	**NSQF Level 7** B.Voc. Graduate
	6		

Note: A student has to earn additional 1 credit per year for Universal Human Value Education Course.

B.Voc. Radiation & Imaging Technology

Semester-I

S.N.	**Paper No.**	**Subject**	**Credit**	**Marks**
1.	BVRIT-101	**Fundamental Physics**	3	100
2.	BVRIT-102	**Human Anatomy & Physiology 1**	3	100
3.	BVRIT-103	**Basics of X – Ray technology**	3	100
4.	BVRIT-104	**Basic Functional English**	3	100
5.	BVRIT-105	**Practicals-1, 2, 3**	18	300
		Total	**30**	**700**

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SEMESTER I

BVRIT: 101 Fundamental Physics

1) Basic concepts: Basic Units, Heat, Acoustics etc. Basic concepts of power, work, force, energy - Einstein's formula - Electronics, Electricity & Magnetism, - electromagnetic waves - Units and measurements - temperature and heat-SI units of above parameters-Atomic structure- Nucleus - Atomic Number, Mass Number electron orbit and energy levels-Periodic table -Isotopes-Isobars-Ionisation and excitation.

2) Introduction to Vector Algebra :- Basics Concepts of vector, Vector addition Resolution of Vectors into component in 2 and 3 dimension Vector and Scalar products

3) Properties of Matter: -

Solid Mechanics: - Introduction to different elastics constant, Practical applications of elasticity

Fluid Mechanics: - Pascal Law and hydraulic lift, Bernoulli's equation and its applications Viscosity and stock's law and terminal velocity, Molecular interpretation of surface tension

4) Basics of Electricity and Electronic

Electricity :- Ohm's Law and Concept of Resistance , Series and Parallel Connections of Resistance , e.m.f. , internal resistance and terminal Voltage of cell , Whetstone Bridge and Potentiometer circuit

Electronic: - Introduction to PN Junction Diode, LED and Photo Diode, Basics of Transistor and characteristics of transistor logic gates. – triode valves – cathode ray oscilloscopes. Self rectifying circuits

5) Fundamental of Optics

Ray optics: - Laws of reflection and mirror formula , Laws of refraction , change in height , depth , Image formation by lenses and Lens formula

Wave optics: - Interference. Young's experiment and condition of constructive and destructive interference, introduction to diffraction and polarization

Solid Mechanics: - Introduction to different elastics constant, Practical applications of elasticity

Fluid Mechanics: - Pascal Law and hydraulic lift, Viscosity and stock's law and terminal velocity , Molecular interpretation of surface tension

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SEMESTER I

BVRIT: 102 HUMAN ANATOMY & PHYSIOLOGY 1

1. General Anatomical Terms

2 Different parts of the body

3. Description of a typical animal cell: Cell mitosis; genes; sex cell; ova and spermatozoa. Fertilisation of the ovum. Broad lines of embryonic development. Cell function and differentiation of tissues.

4. Structure of General Tissues
Epithelium; simple and complex epithelia; glands skin. Connective tissue; fibrous tissue; cartilage; bone; Haversian systems; blood numbers and types of cells in blood clotting of blood. Muscle tissue; involuntary, voluntary and cardiac muscle. Nerve tissue.

5 Nature of neoplasm's : Common benign tumours. Malignant tumours and their dissemination

6 Bones, joints and locomotors system: General description of bones, their main processes and attachments

7. Thorax and Abdomen: Structure of thoracic cage, abdominal cavity; diaphragm and mediastinum.

8 Heart and Blood Vessels : Structure and function of the heart, pericardium, peripheral vascular system; names of main arteries and veins, circulation. Common terms used in connection with diseases of this system.

9. Respiratory system : Nasal passages and accessory nasal sinuses, pharynx and larynx, trachea, bronchi and lungs; pleura, nature and function of respiration. Common terms used in connection with diseases of this system.

10. Lymphnode Groups: Lymph and tissue fluid, main lymphatic gland groups and drainage areas, lymphoid tissue and tonsil.

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SEMESTER I

BVRIT: 103 Basics of X – Ray technology

1) Basic of .X-rays : Discovery of x-rays- properties-production- x-ray spectrum-bremsstrahlung and characteristic x-rays- X-ray tube; Coolidge tube, tube design, line focus principle-space charge effect, tube cooling- Modern x-ray tubes-stationary anode, rotating anode, grid controlled x-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-,factors influencing them.

2) X-ray generator circuits: Vacuum tube diodes-semiconductor diodes-transister-rectification, half and full wave-self rectification – X-ray generator; filament circuit-kilo voltage circuit-single phase generator-three phase generator-constant potential generator Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthling

3) Interaction of X-and Gamma rays: Attenuation of X-ray or Gamma rays-absorption and scattering-half value layer-coherent scattering-Photo electric absorption-compton scattering-pair production and photoelectric disintegration. X-Ray transmission through medium-linear and mass attenuation coefficients. HVT - TVT and interaction of charged particle and neutrons with matter. Interaction of X-and Gamma rays in body-fat-soft-tissue-bone-contrast medium-Total attenuation coefficient. Relative important of different types of interactions.

4) Physics of Diagnostic Radiology : Anode & Cathode - Thermionic diode – X-ray valves and tubes –principle and practical aspects – semiconductors – triode valves – cathode ray oscilloscopes – X-ray circuits – self rectifying circuits – half wave pulsating voltage circuits – full valve pulsating voltage circuits - measurement of high voltage – control of KV circuit – mA circuit. X-ray beam quality.X-Ray generators and circuits-Filament current and voltage, X-Ray circuits -primary circuit-auto transformer-switch and timers- principle of automatic exposure control and practical operation - filament circuit -high voltage circuits

5) X-ray tables :- -floating top table & variable height table. X-Ray Grids /Bucky Scattered Radiation -Significance of scatter – Beam limiting devices.-Grid principle and structure – Types of Grids - vertical bucky- versatile bucky -Stationary grid, parallel grid, focused grid – crossed grid, moving grid – Potter Bucky Diaphragm-Control of scattered radiation and grids/Bucky - Methods of minimizing formation of scatter radiation, types of grids and grid ratio- use of cones – diaphragm/ light beam devices - effectiveness of collimation - limitations of the primary beam/the light beam diaphargm -Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure. X-Ray Casettes & Intensifying screens:

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SEMESTER I

BVRIT: 104 Basic Functional English

1. Grammar

Determiners

Tenses, Defining a Verb, Chief forms of a Verb, Tense and Time, Further Division of Tenses, The Present Tense, ,The Past Tense, The Future Tense Active – Passive Voice, Introduction, Defining the Voice, Some General rules regarding the change of voice Modals & Auxiliaries, Introduction to Auxiliaries, The Primary Auxiliaries, Introduction to Modals, The Most Commonly used Modals, Important points about the Modals, Modals and Their Uses Prepositions / Prepositional Phrases

2. Writing Comprehension

Business Letters: Introduction, Functions of a Business, Letter, Inward Structure / Layout of a Business Letter, Other Important Parts of Business Letter, Outward appearance of a business letter, Arrangement Styles, Salient Features of a Business Letter, Legal Aspects of a business Letters, Kinds of Business Letter, Inquiry & Reply Order & Reply Cancellation of order Complaint / Adjustment Sales Letter

3. Report Writing:

Introduction, The Nature of a Report, The P's of an Effective Report, Functions of a Report, Preparing a Report, Types of Reports, Press report

Job Application / Resume Writing. Introduction, a Cover Letter, Curriculum Vitae / Resume

Letters of Appointment & Resignation

Conversations based on everyday situation / Dialogue Writing. Introduction, Nature of Conversations, Purpose of conversation, Guidelines for Effective

4. Conversation Skills:

Proverbs used in Everyday Conversation with their Meanings / Explanations Comparisons used in Everyday Conversation, Practical Conversations

(1) Communication – Meaning, Features & Process

(2) Verbal & Non – Verbal comm.

Verbal, Oral Communication, Written Communication, Non – Verbal, Body language, Space Para language, others Group discussion skills, Meaning, Characteristic, Do's & Don'ts, Relevance, Moderating a group discussion, Presentation skills, Meaning, Planning a presentation skills, Preparing a presentation skills Delivering a presentation skills, Presentation skills, Public Speaking, Meaning, Essential of effective public speaking Facing Interviews, Importance, Do's & Don'ts

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B. Voc. Radiation & Imaging Technology

LABORATORY COURSE

SEMESTER I

BVRIT: 105 PRACTICAL

Laboratory course of B.Voc. Radiation & Imaging Technology includes practicals based on following subjects.

- **Fundamental physics**
- **Human Anatomy & Physiology 1**
- **Basics of X – Ray technology**

B. Voc. Radiation & Imaging Technology

SEMESTER END UNIVERSITY EXAMINATION

THEORY QUESTION PAPER STYLE- Semester I & II

Time: 2:30 hrs **Theory- Total Marks-70**

Que.:1 Objective type Q & A - 30 Marks

SN	Type	No. of Que.	Weightage	Marks
I	MCQs	10	1 mark	10
II	MCQs	10	2 marks	20
			Total	**30 marks**

Que.:2 Subjective type Q & A - 20 Marks

Any **Four** out of Six Questions - Each carrying **5 marks**- Total- 20 marks

Que.:3 Subjective type Q & A - 20 Marks

Any **Four** out of Six Questions - Each carrying **5 marks**- Total- 20 marks

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PRACTICAL - Semester I	**PRACTICAL - Semester II**
Days: 02 **Time: 6 hrs/day**	**Days: 03** **Time: 6 hrs/day**
Practical - 250 Marks **Viva voce - 50 Marks**	**Practical - 200 Marks** **Viva voce - 50 Marks**
	Training Report or Project Report - 100 marks **Viva voce - 50 Marks**

B. Voc. Radiation & Imaging Technology

INTERNAL EVALUATION - THEORY

Semester I & II

Marks per Paper 30 marks

SN	Detail	Marks
1	MCQ – Objective test	10
2	Attendance & Theoretical Assignment/ Seminar	10
3	Theoretical &/or Practical Assignment	10
	Total	**30 marks**

No Internal Evaluation for Practical & Project/Training Components