HSNC University , Mumbai

Board of Studies in Faculties of Science and Technology

Board of Studies in Physics

1. Name of Chairperson/Co-ChairpersonCoordinator

a. Mrs. Anita Ravi (Associate Professor and HOD, Department of Physics, K C College, Mumbai.)anita.ravi@kccollege.edu.in 9892121767

2. Two to five teachers each having minimum five years teaching experience amongst the full time teachers of the Department in the relevant subject

a. Dr. Shaila Wagle, Associate Professor, Department of Physics, K C College shaila_wagle@yahoo.com 9820122689

b. Dr. Jyotsna Pandey, Assistant Professor, Department of Physics, K C College jyotsna.pandey@kccollege.edu.in 9664466033

3. One Professor/Associate Professor from other Universities or Professor/Associate Professor named by Parent Body ; nominated by Parent Body

a. Dr. Anuradha Mishra Professor & Head, Department of Physics, Mumbai University, misra@physics.mu.ac.in 9867016176

4. Four external experts from industry/research/eminent scholar in the field relevant to the subject nominated by the Parent Body

a. Dr. G P Kothiyal, Former Head, Glass and Ceramics Division, BARC, Current Chairman, Material Science Research Centre

gpkothiyal@yahoo.co.in 9757000215

b. Dr. Dinesh Kala, Associate Professor & HOD, G N Khalsa College. kaladc10964@gmail.com 9892109094

c. Dr. Mohan Narayan, Associate Professor & HOD, Department of Physics, Institute of Chemical Technology, Mumbai m.narayan@ictmumbai.edu.in 9892906162

d. Dr. A P Jayaraman, President, STEAM Academy, Former Nuclear scientist, BARC, Chairman, National Centre for Science Communicators drap.jayaraman@gmail.com 9819966601

5.Top Ranking student

a. Ms. Ashlesha Pujara, Top Ranking Ex-student (2017 -19 batch) Department of Physics, K C College pujaraashlesha@gmail.com 9867850315

R. **** : **The Definitions Of The Key Terms Used In The Choice Based Credit System And Grading System Introduced From The Academic Year 2020-2021 Are As Under:**

Outline of Choice Based Credit System as outlined by University Grants Commission:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 **Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

The University/Institute may also offer discipline related Elective courses of **interdisciplinary** nature (to be offered by main discipline/subject of study).

2.2 **Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

2.3 **Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; EC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Choice Base Credit System

CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill-oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.

Honours Program

To enhance employability and entrepreneurship abilities among the learners, through aligning Inter Disciplinary / Intra Disciplinary courses with Degree Program. Honours Program will have 40 additional credits to be undertaken by the learner across three years essentially in Inter / Intra Disciplinary course.

A learner who joins Regular Undergraduate Program will have to opt for Honours Program in the first year of the Program. However, the credits for honours, though divided across three years can be completed within three years to become eligible for award of honours Degree.

Program:

A Program is a set of course that are linked together in an academically meaningful way and generally ends with the award of a Degree Certificate depending on the level of knowledge attained and the total duration of study, B.Sc. Programs.

Course:

A 'course' is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a course must necessarily have academic coherence, i.e. there must be a common thread linking the various components of a course. A number of linked courses considered together are in practice, a 'program'.

Bridge Course:

Bridge course is visualized as Pre semester preparation by the learner before commencement of regular lectures. For each semester the topics, whose knowledge is considered as essential for effective and seamless learning of topics of the Semester, will be specified. The Bridge Course can be conducted in online mode. The Online content can be created for the Bridge Course Topics.

Module and Unit:

A course which is generally an independent entity having its own separate identity, is also often referred to as a 'Module' in today's parlance, especially when we refer to a 'modular curricular structure'. A module may be studied in conjunction with other learning modules or studied independently. A topic within a course is treated as a Unit. Each course should have exactly 3 Units.

Self-Learning:

20% of the topics will be marked for Self-Learning. Topics for Self-Learning are to be learned independently by the student, in a time-bound manner, using online and offline resources including online lectures, videos, library, discussion forums, field work, internships etc.

Evaluative sessions (physical/online), equivalent to the credit allocation of the Self Learning topics, shall be conducted, preferably, every week for each course. Learners are to be evaluated real time during evaluative sessions. The purpose of evaluative sessions is to assess the level of the students' learning achieved in the topics earmarked for Self-Learning.

The teacher's role in these evaluative sessions will be that of a Moderator and Mentor, who will guide and navigate the discussions in the sessions, and offer concluding remarks, with proper reasoning on the aspects which may have been missed by the students, in the course of the Self-Learning process.

The modes to evaluate self-learning can be a combination of the various methods such as written reports, handouts with gaps and MCQs, objective tests, case studies and Peer learning. Groups can be formed to present self-learning topics to peer groups, followed by Question and Answer sessions and open discussion. The marking scheme for Self Learning will be defined under Examination and Teaching.

The topics stipulated for self-learning can be increased or reduced as per the recommendations of the Board of Studies and Academic Council from time to time. All decisions regarding evaluation need to be taken and communicated to the stakeholders preferably before the commencement of a semester. Some exceptions may be made in exigencies, like the current situation arising from the lockdown, but such ad hoc decisions are to be kept to the minimum possible.

Credit Point:

Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single course always pay attention to how many hours it would take for a learner to complete a single course successfully. A single course should have, by and large a course may be assigned anywhere between 2 to 8 credit points wherein 1 credit is construed as corresponding to approximately 30 to 40 learning hours.

Credit Completion and Credit Accumulation:

Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single course. Thus, a learner who successfully completes a 4 CP (Credit Point) course may be considered to have collected or acquired 4 credits. learner level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more courses. Thus the learner 'accumulates' course wise credits.

Credit Bank:

A Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the course/s for which Credit has been given, the course-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history.

Credit Transfer:

(performance transfer) When a learner successfully completes a program, he/she is allowed to transfer his/her past performance to another academic program having some common courses and Performance transfer is said to have taken place.

Course Exemption:

Occasionally, when two academic programs offered by a single university or by more than one university, may have some common or equivalent course-content, the learner who has already completed one of these academic programs is allowed to skip these 'equivalent' courses while registering for the new program. The Learner is 'exempted' from 'relearning' the common or equivalent content area and from re-appearing for the concerned examinations. It is thus taken for granted that the learner has already collected in the past the credits corresponding to the exempted courses.

Note: The Ordinances and Regulations given below are applicable to Program of STATS under faculty of Science, unless and otherwise specified.

O***

Minimum duration of the STATS programme will be of 3 years in the Semester pattern i.e. from Sem. I to Sem. VI.

The degree will be awarded to a learner who successfully completes 120 credits of the programme in period of 3 to 6 years from the year of enrollment to semester VI.

If a learner does not earn 120 credits in 12 semesters from the year of enrolment to semester I, he/she may at his/her option transfer his/her performance in the existing/new program after establishing equivalence between old and new syllabus. Such a performance transfer will be decided by the Board of Studies / Ad-hoc Board / Ad hoc Committee of the concerned subject. The admission to the program will be governed by the existing rules

O*** The fees for transfer of credits or performance will be based on number of credits that a learner has to complete for award of the degree.**

R **** Credits earned at one institution for one or more courses under a given program will be accepted under another program either by the same institution or another institution either through Direct Performance Transfer or Course exemption.

R** **The Scheme of Teaching and Examination**:
The Scheme of Teaching and Examination shall be divided into THREE components, SELF LEARNING, Internal assessment and External assessment (semester end examination) for each course of the program.

1) **SELF LEARNING** Assessment. Some methodology has been described in Definition of Self Learning. However Subject Teacher is authorized to devise newer methods of evaluation, which must essentially be documented and circulated through mail or written circular to the learners at least 7 days prior to its implementation. 10% of the marks shall be allocated for Self Learning assessment.

2) **Internal Assessment** includes Assignments, Seminars, Core Practical, Practical, Commutative Test, Practical Record, Unit Tests etc. Subject Teacher is authorized to devise newer methods of evaluation, which must essentially be documented and circulated through mail or written circular to the learners at least 7 days prior to its implementation. For each course, there is a passing minimum for internal Assessment as 40% (16 out of 40 marks).

3) **Semester End Examination** 60% (24 out of 60 marks) overall 40% (40 out of 100 marks).

HSNC University, Mumbai

Ordinances and Regulations

With Respect to

Choice Based Credit System
(CBCS)

For the Programs under

The Faculty of Science and Technology

In the subject of

Physics

With effect from the Academic year 2020-2021.

Preamble:

The laws and concepts developed by the subject of Physics encompasses the forces of nature . These forces permeate every aspect of life and by this virtue the study of Physics becomes imperative for any basic science course.

The undergraduate course in Physics is designed to give an in depth knowledge of all fundamental ideas developed in this subject with the aim of firmly entrenching them in the minds of students.

The F.Y.B.Sc degree in Physics (FP) is a part of the choice based credit system comprising of two semesters. Each semester consists of two courses in theory and one course in practicals.

Objectives:

This curriculum is designed to initiate students to basic concepts and laws of physics with further development of the subject in the second and third year of the course. The objectives are

- to reinforce deep understanding of concepts and principles of Physics
- to enable application of concepts and principles to solve problems and to real life situations.
- to enrich knowledge through assignments, projects, field/institutional visits
- to familiarize students with the current research trends
- to encourage interdisciplinary enrolment with introduction of common areas of interest'
- to enhance skills which will improve chances of employment and entrepreneurship.

The Scheme of Teaching and Examination is as under:

First Year Semester – I

Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course **(Physics)**			US-FPH-101, US-FPH -102, US-FPH-1P1	
2	Elective Course	Discipline Specific Elective (DSE) Course			
		2.1	Interdisciplinary Specific Elective (IDSE) Course		
		2.2	Dissertation/Project		
		2.3	Generic Elective (GE) Course		
3	Ability Enhancement Courses (AEC)				
	Skill Enhancement Courses (SEC)				

Detail Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week						Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P	Credit	S. L. E	CT	TA	SEE	
1	US-FPH-101	MATHEMATICAL PHYSICS - I	3	20% *	3	0	0	2	10	20	10	60	100
2	US-FPH-102	MECHANICS-I	3	20% *	3	0	0	2	10	20	10	60	100
3	US-FPH-P-1	Practical Based on US-FPH-101 + Practical Based on US-FPH-102	-	-	0	0	3	2	-	-	-	100 (40 + 5 + 5 + 40 + 5 +5)	100
	Total Hours / Credit							06	Total Marks				300

***One to two lectures to be taken for CONTINUOUS self -learning Evaluation.**

I Year - Semester – I - Units – Topics – Teaching Hours

S. N	Subject Code	Subject Unit Title		Hours /Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	US-FPH -101	I	Vector Differentiation, Integration & Curvilinear coordinates	15	45 L	2	100 (60+40)
		II	Introduction to Probability & Theory of Errors	15			
		III	First and second order differential equations	15			
2	US-FPH-102	I	Fundamentals of Dynamics, Work & Energy	15	45L	2	100 (60+40)
		II	Collisions, Elasticity, Fluid Motion & Gravitation	15			
		III	Compound Pendulum & Centre of Mass	15			
3	US-FPH-P-1	I	Practical based on US-FPH-101 & US-FPH-102	3	45 L	2	100 (40 + 5 + 5 + 40 + 5 + 5)
			TOTAL			6	300

- **Lecture Duration – 45 Minutes = 0 .75 Hours. (45 Lectures equivalent to 33.75 hours)**
- **One Credit =16.87 hours equivalent to 17 Hours**

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT

Course Code: US-FPH -101

Unit	Content	No. of Lectures
1	**1. Vector Differentiation & Integration**	
	1.1 **Recapitulation** Scalar product, vector product, triple products, scalar and vector fields.	**15**
	1.2 **Vector differentiation** Del operator, Gradient of a scalar field and its physical interpretation, Divergence and curl of a vector field and their physical interpretation, Vector identities, Laplace	

operator

1.3 **Vector Integration** Notion of infinitesimal line, surface and volume elements, Line, surface and volume integrals, Flux of a vector field, Gauss' divergence theorem, Green's theorem, Stokes' theorem (no rigorous proof)

1.4 **Curvilinear Coordinates**
Orthogonal Curvilinear coordinates, gradient divergence curl and Laplacian in cartesian, spherical and cylindrical coordinate systems.

2 **2. Introduction to probability & Theory of Errors**

2.1 Introduction to probability
Independent random variables, mean and variance, probability distribution functions, Binomial, Gaussian and Poisson distribution, dependent events – conditional probability, Bayes' theorem and hypothesis testing **15**

2.2 Theory of Errors
Systematic and random errors, Standard and probable error, propagation of error, least square fit, error of slope and intercept of a fitted line.

3 **3. First order & Second order differential equations**

3.1 First order differential equations
Introduction to ordinary differential equations, First order differential equation and integrating factor. Application to DC dc series LR and CR circuits.

15

3.2 Second order differential equations
Second order homogeneous equations with constant coefficients, Wronskian and general solution, Statement of existence and uniqueness theorem for initial value problems. Second order nonhomogeneous equations with constant coefficients and particular integral.

Self-Learning topics (Unit wise)

Unit	Topics
1	1.1 **Recapitulation**
3	**3.1 First order differential equations**

Online Resources

Reference:- http// nptel.ac.in
Web Course Mathematical Physics Chapter I Title Quantities I Dr. Saurabh Basu.

Reference books:-

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Mathematical Physics, Goswami, 1st edition, Cengage Learning
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press
- An introduction to ordinary differential equations E A Coddington 2009 PHI learning
- Differential Equations George F Simmons 2007 McGraw Hill

Course Code: US-FPH-102

Unit	Content	No. of Lectures
I	**1. Fundamentals of Dynamics & Work and Energy**	
	1.1 Fundamentals of Dynamics Reference frames, inertial/noninertial frames, Newton's laws of motion, momentum of a variable mass system – motion of a rocket, motion of a projectile in a uniform gravitational field, Galilean transformation, Galilean invariance,	**15**
	1.2 Work and Energy Work and kinetic energy theorem, conservative and nonconservative forces, potential energy, stable and unstable equilibrium, elastic potential energy, force as a gradient of potential energy, work and potential energy, work done by conservative forces, law of conservation of energy.	
II	**2. Collisions, Elasticity, Fluid Motion & Gravitation**	
	2.1 Collisions Elastic and inelastic collisions between particles, centre of mass and laboratory frames.	**15**
	2.2 Elasticity Relation between elastic constants, twisting torque on a cylinder	

or wire.

2.3 Fluid Motion

Kinematics of moving fluids – Poiseuille's equation for flow of a liquid through a capillary tube, Streamline and turbulent flow. Non ideal fluids/Reynolds number

2.4 Gravitation

Law of gravitation, gravitational potential energy, inertia and gravitational mass, potential and field due to spherical shell and solid sphere .

III **3. Compound Pendulum & Centre of mass**

3.1 Compound Pendulum

Expression for period, maximum and minimum time period, centres of suspension and oscillation, reversible compound pendulum, Kater's reversible pendulum, compound pendulum and simple pendulum – a relative study.

15

3.2 Centre of mass

Motion of centre of mass, linear momentum of a particle, linear momentum of a system of particles, linear momentum w.r.t CM (shift of origin from lab to CM), conservation of linear momentum, some applications of momentum principle, system of variable mass

Self-Learning topics (Unit wise)

Unit	Topics
3	3.2 **Centre of mass**

Online Resources

Reference:- http// nptel.ac.in
Video Course Mechanics Heat Oscillations and waves Prof. V. Balakrishnan.

Reference books:-

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.

- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.
- Mechanics H S Hans and S P Puri, 2nd ed, Tata McGraw Hill

Course Code: US-FPH- P1

(Practical based on US-FPH-101 & US-FPH-102)

Total Credit: 2

CONTENTS	No. of Lectures
Section I (Practical based on US-FPH-101) 1. To study motion of a spring and to calculate spring constant and g. 2. To determine Young's Modulus of a spring using a Flat spiral spring 3. To determine Modulus of rigidity of a spring using a Flat spiral spring 4. To determine Young's Modulus of a beam by the method of bending 5. To determine modulus of rigidity of a wire by torsional oscillations 6. To determine coefficient of viscosity of water by Poiseuille's method 7. To determine 'g' using bar pendulum 8. To determine 'g' using Kater's Pendulum **SectionII (Practical based on US-FPH-102)** 1. Error calculations in experiments 2. LASER Beam Profile and Gaussian distribution 3. Graph plotting using Excel	33 lectures per batch per practical

4. Data analysis – calculation of mean value, standard deviation 5. Series LR circuit and application of first order differential equation 6. Series CR circuit and application of first order differential equation 7. Spring mass oscillator and application of second order differential equation to SHM	

Reference books:-

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
- Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

I Year - Semester – II Units – Topics – Teaching Hours

Detail Scheme

1	Subject Code	Subject Title	Periods Per Week						Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P	Credit	S. L. E	CT	TA	SEE	
1	US-FPH-201	Electricity and Magnetism	3	20 % *	3	0	0	2	10	20	10	60	100
2	US-FPH-202	Waves and Oscillations	3	20 % *	3	0	0	2	10	20	10	60	100
3	US-FPH-P-2	Practical Based on US-FPH-201 + Practical Based on US-FPH-202	-	-	0	0	3	2	-	-	-	100 (40 + 5 + 5 + 40 + 5 +5)	100
	Total Hours / Credit							06	Total Marks				300

S. N	Subject Code	Subject Unit Title		Hours /Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	US-FPH-201	I	Electric Field & Electric Potential	15	45L	2	100 (60+40)
		II	Magnetic Field , Electromagnetic induction & Ballistic galvanometer	15			
		III	Electrical circuits & Network Theorems	15			
2	US-FPH-202	I	Superposition of two collinear harmonic oscillations & Superposition of two perpendicular harmonic oscillations	15	45L	2	100 (60+40)
		II	Wave Motion & Velocity of waves	15			
		III	Superposition of two harmonic waves	15			

3	US-FPH-P-2	II	Practical based on US-FPH-201 & US-FPH-202	3	45L	2	100 (40 + 5 + 5 + 40 + 5 + 5)
			TOTAL			6	300

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT

Course Code: US-FPH-201

Unit	Content	**No. of Lectures**
I	**1. Electric Field & Electric Potential**	
	1.1 Electric Field Electric field lines, electric flux, Gauss' Law and its applications to charge distributions with spherical, cylindrical and planar symmetries.	**15**
	1.2 Electric Potential Conservative nature of electric field, electrostatic potential, Laplace's and Poisson's equation, the first uniqueness theorem, potential and electric field of a dipole, force and torque on a dipole	
II	**2. Magnetic Field, Electromagnetic induction & Ballistic galvanometer**	
	2.1 Magnetic Field Magnetic force between current elements and definition of magnetic field **B**, Biot savart law and its simple applications to straight wire and circular loop, current loop as a magnetic dipole and its magnetic moment (analogy with an electric dipole).	
	2.2 Electromagnetic induction Faraday's law, Lenz's law, self and mutual inductance, Energy stored in a magnetic field	**15**
	2.3 Ballistic galvanometer Torque on a current loop, ballistic galvanometer – charge and current sensitivity, electromagnetic damping, logarithmic damping, CDR	
III	**3. Electrical circuits & Network Theorems**	
	3.1 Electrical circuits ac circuits, Kirchoff's law for ac circuits, complex reactance and	**15**

impedance, series LCR circuit – resonance, power dissipation, bandwidth and quality factor, parallel LCR circuit.

3.2 Network Theorems

Ideal Constant voltage and constant current sources, Thevenin's theorem, Norton's theorem, superposition theorem, Reciprocity theorem, Maximum power transfer theorem and application to dc circuits.

Self-Learning topics (Unit wise)

Unit	Topics
1	**1.2. Electric Potential**

Online Resources

Reference:- http// nptel.ac.in
Video Course Introduction to electromagnetism Prof. Manoj Harbola.

Reference books:-

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

Course Code: US-FPH-202

Unit	Content	No. of Lectures
I	**1. Superposition of two collinear harmonic oscillations & Superposition of two perpendicular harmonic oscillations**	
	1.1 Superposition of two collinear harmonic oscillations Linearity and superposition principle, superposition of two collinear oscillations having equal frequencies and different frequencies (beats), superposition of N collinear harmonic oscillations with equal phase differences and equal frequency differences.	**15**
	1.2 Superposition of two perpendicular harmonic oscillations	

Graphical and analytical methods, Lissajous figures with equal and unequal frequencies and their uses

II **2. Wave Motion**

2.1 Wave Motion

Plane and spherical waves, transverse and longitudinal waves, plane progressive (travelling) waves, wave equation, particle and wave velocities, differential equation, pressure of a longitudinal wave, wave intensity, energy transport, water waves – ripple, gravity waves. **15**

III **3. Superposition of two harmonic waves**

3.1 Superposition of two harmonic waves

Transverse vibrations of stretched string and applications, longitudinal waves in a fluid in a pipe and applications, Standing (stationary) waves on a string, fixed and free ends, analytical treatment, phase and group velocities, changes with respect to position and time, energy of vibrating string, energy transfer, normal modes of a stretched string, plucked and stretched strings, Melde's experiment, longitudinal standing waves and normal modes, open and closed pipes, superposition of N harmonic waves **15**

Self-Learning topics (Unit wise)

Unit	Topics
1	**1.1 Superposition of two collinear harmonic oscillations**

Online Resources

Reference:- http// nptel.ac.in
Video Course Waves and Oscillations Dr. M S Santhanam

Reference books:-

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons
- The Physics of Waves and Oscillations, N.K. Bajaj, 2010Tata McGraw Hill.

Course Code: US-FPH- P2

(Practical based on US-FPH-201 & US-FPH-202)

Total Credit: 2

CONTENTS	No. of Lectures
Section I (Practical based on US-FPH-201) 1. To determine the charge and current sensitivity of a ballistic galvanometer 2. To determine self-inductance of a coil by Rayleigh's method 3. To determine mutual inductance by B.G 4. To verify maximum power transfer theorem. 5. To verify Thevenin's theorem. 6. To verify Norton's theorem 7. To study response curve of a series LCR circuit and determine the resonance frequency, impedance at resonance, quality factor and bandwidth 8. To study response curve of a parallel LCR circuit and determine the antiresonance frequency and quality factor. **Section II (Practical based on US-FPH-202)** 1. To determine the frequency of a tuning fork by Melde's experiment and verify λ^2 – T law 2. To study Lissajous figures 3. Frequency of ac mains 4. Helmholtz resonator 5. Study of vibrations in a stretched string with application to musical instruments 6. Resonance Pendulum 7. To study phenomenon of beats.	3 lectures per practical

Reference books:-

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House

- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal 15
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

L: Lecture: Tutorials P: Practical Ct-Core Theory, Cp-Core Practical, CT-Commutative Test, TA-Teacher Assessment

The semester end examination (external component) of 60% will be as follows:
1) Duration – 2 Hours

2) i) Theory Question Paper Pattern: -

a) There shall be four questions. On each unit there will be one question with 15 Marks each & fourth one will be based on all the three units with 15 Marks.
b) All questions shall be compulsory with internal choice within the questions. Question 1 (Unit-I), Question 2 (Unit-II) & Question 3 (Unit-III) and Question 4 (combined units) will be of 60 Marks with internal options.
c) Questions I, II and III may be sub divided into sub questions of short or long questions of 2 to 5 marks each. Please note that the allocation of marks depends on the weightage of the topic. Question IV will be objective questions.

2) ii) Practical Question Paper Pattern: -

Semester End Examination-40 Marks per Paper

Sr. No.	Particulars	Marks	Total
1	Laboratory work (2 experiments)	40 + 40	80
2	Journal	10	10
3	Viva	10	10
	Grand Total	**100**	**100**

PRACTICAL BOOK/JOURNAL

Semester I:

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.
In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Semester II:
The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.
In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

3) The marks will be given for all examinations and they will be converted into grade (quality) points. The semester-end, final grade sheets and transcripts will have only credits, grades, grade points,

4) The assessment of Part 'A' i.e. Internal Assessment as mentioned above for the Semesters I &VI shall be processed by the Colleges / Institutions of their learners admitted for the programme while the University shall conduct the assessment of Part 'B' i.e. Semester End Examination for Semesters I & VI.
The Internal Assessment marks of learners appearing for Semesters I & VI shall be submitted to the University by the respective colleges/ Institutions before the commencement of respective Semester End Examinations. The Semester End Examinations for Semesters I & VI shall be conducted by the University and the results shall be declared after processing the internal assessment and the marks awarded to the learners. The grade card shall be issued by the University after converting the marks into grades.

5) The marks of the internal assessment should not be disclosed to the students till the results of the corresponding semester is declared.

R.**** Passing Standard And Performance Grading:**
PASSING STANDARD:
The learners to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment & Semester End Examination. The learners shall obtain minimum of 30% marks (i.e. 12 out of 30) in the Internal Assessment and 70% marks in Semester End Examination (i.e. 24 Out of 60) separately, to pass the course and minimum of Grade E in each project, wherever applicable, to pass a

particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment & Semester End Examination together.

PERFROMANCE GRADING:

The Performance Grading of the learners shall be on the TEN point ranking system as under:

Grade	Marks Grade	Points
O+	90 & above	10
O	80 to 89.99	9
A+	70 to 79.99	8
A	65 to 69.99	7
B+	60 to 64.99	6
B	55 to 59.99	5
C	50 to 54.99	4
D	45 to 49.99	3
E	40 to 44.99	2
F	(Fail) 39.99 & below	1

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

R. ** Carry Forwards of Marks: In Case of A Learner Who Fails In The Internal Assessment And /Or Semester End Assessment In One Or More Subjects:**

1) A learner who PASSES in the Internal Examination but FAILS in the Semester End Examination of the course shall re-appear for the Semester End Examination of that course. However, his/her marks of the Internal Examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

2) A learner who PASSES in the Semester End Examination but FAILS in the Internal Assessment of the course shall re-appear for the Internal Examination of that course. However, his/her marks of the Semester End Examination shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

R.** ALLOWED TO KEEP TERMS (ATKT):**

a. A learner shall be allowed to keep term for Semester II irrespective of number of heads of failure in the Semester I.

b. A learner shall be allowed to keep term for Semester III if he/she passes each of Semester I and Semester II

OR

learner who fails in not more than two courses of Semester I and Semester II taken together.

c. A learner shall be allowed to keep term for Semester IV irrespective of number of heads of failure in Semester III. However, the learner shall pass each course of Semester I and Semester II in order to appear for Semester IV.

d. A learner shall be allowed to keep term for Semester V if he/she passes Semester I, Semester II, Semester III and Semester IV

OR

learner shall pass Semester I and Semester II and fails in not more than two courses of Semester III and Semester IV taken together.

e. A learner shall be allowed to keep term for Semester VI irrespective of number of heads of failure in the Semester V. However, the learner shall pass each course of Semester III and Semester IV in order to appear for Semester VI.

f. The result of Semester VI of a learner, in regular program, shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV and Semester V.

g. The result of Semester VI of a learner, in Honours program, shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV and Semester V and additional

R. ** ADDITIONAL EXAMINATION:**
INTERNAL ASSESSMENT:

Eligibility norms to appear for the additional class test or assignment or project for learners who remained absent:

a. The learner must apply to the Head of the Institution / School / Department giving the reason(s) for absence within 8 days of the conduct of the examination along with the necessary documents and testimonials.

b. If the learner is absent, on sanctioned lave from head of Institution / School / Department, for participation in Inter Collegiate events, State or National or International level events, Training camp or coaching camp organized by authorized university or state or national or international bodies, NSS / NCC Events / Camps / cultural activities / sports activities / research festival or any other activities authenticated by the head of the institution, the head of the Institution shall generally grant permission to the learner to appear for the additional class test or assignment.

c. The Head of the Institution, on scrutiny of the documents and testimonials, may grant the permission to the learner to appear for the additional examination.

Class test or assignment for Internal Assessment:

a. A learner who is absent for the class test and for all the assignment/s will be declared fail in the Internal Assessment Scheme.

b. A learner who is absent for the class test and has appeared for all the assignment/s will be allowed to appear for the additional class test

c. A learner who has appeared for the class test but remains absent for all the assignment/s will be allowed to appear for only one additional assignment.

d. A learners who is absent for the class test or one assignment as the case may be the learner will be allowed to appear for the additional class test/assignment.

The Additional Class Test (or viva examination) or Assignment must be conducted 15 days prior to the commencement of the Semester End Examination after following the necessary procedure and completing the formalities.

SEMESTER END EXAMINATIONS

Eligibility to Appear For Additional Semester End Examination:

a. A learner who does not appear i.e. remains absent in some or all the courses on medical grounds or for representing the college / university in sports, cultural activities, activities of NSS, NCC or sports training camps conducted by recognized bodies / competent authorities or for any other reason which is considered valid under exceptional circumstances and to the satisfaction of the
Principal or the Head of the Institute OR fails n some or all the subjects is eligible to appear for the additional examination.

A learner who does not appear for both the Internal Assessment and Semester End Examination shall not be eligible to appear for the additional Semester End Examination.
The additional Semester End Examination shall be of two and half hours duration and of 70 marks. The learner shall appear for the course of the Semester End Examination for which he/she was absent or has failed.

MODE OF CONDUCT OF SEMESTER END ADDITIONAL EXAMINATION:

a) There will be one additional examination for semester I, II, III and IV for those who have failed or remained absent.

b) The absent learner will be allowed to appear for the examination by the head of the institution after following the necessary formalities subject to the reasons to the satisfaction of the head of the institution.

c) This examination will be held 20 days after the declaration of results but not later than 40 days.

PROJECT EVALUATION

1. A learner who PASSES IN ALL THE COURSES BUT DOES NOT secures minimum grade of E in project as applicable has to resubmit a fresh project till he/she secures a minimum of grade E.
2. The credits and grade points secured by him/her in the other courses will be carried forward and he/she shall be entitled for grade obtained by them on passing of all the courses.

3. The evaluation of project and viva/voce examination shall be done by marks only and then it will be converted into grade in the Ten point scale and award the same to the learner.

4. A learner shall have to obtain minimum of grade E (or its equivalent marks) in project evaluation and viva/voce taken together to obtain 30% marks in project work.

R.****: **Grade Cum Marks Cards:**
The result gazette and the format of the Grade Cards for the semesters conducted by colleges on behalf of the University will be uniform for all the Colleges / Institutions as indicated in the manual for the faculty.

R.*: Semester wise Credit allocation:**

Subject	Sem-1	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total cridit
Physics	20	20	20	20	20	20	120

R.*** GRACING:** The gracing shall be carried out as per existing ordinances of the University in force.

R.**** **Question Papers Setting, Assessment Pattern:**
1. The question papers shall be set and assessed by the teacher, teaching the course. If the course is taught by more than one teacher, the question paper shall preferably be set jointly and assessment of the sections / questions shall be done by the respective teacher.

2. The College authorities may request the teachers from other institutes teaching the course to set the question paper and/or assess the answer papers. However, for such actions the university authorities may seek proper reasons and justifications from the concerned Head of the Institute.

3. The question paper set by the college in different courses shall be forwarded to the University within 15 days of the declaration of the results for the semester for being placed before the respective Board of Studies, which shall report their observations to the Academic Council and inform the observations of the Board and the Academic Council to the concerned colleges.

R.**** **Centralised Assessment:**
The entire work of assessment of the answer papers at the Semester End Examinations shall be centralized within the premises of the concerned college as per the provisions of the University Act and shall be open to inspection by the University. The College can appoint a Committee of 5 members to plan and conduct the CAP Center to ensure smooth, efficient and effective conduct of CAP and Completion of the Assessment.

R.**** **Verification and Revaluation**:
Shall be as per the existing ordinances and regulation / & VCD of the University.

R.**** **Ex-student:** Learner's who are declared failed, on account of failure at the Internal Assessment and/or Semester End Examinations or who have been allowed to keep terms for the higher class shall appear as ex-student for the Internal Assessment and/or the Semester End Examination in the failed course at the examinations held by their respective college. Examination for the ex-students will be held at least 15 days prior to the Semester End

Examination of the next Semester as per the pattern of the course in the respective (failed) semester examination. The examinations for the ex-students shall be held in every semester.

R.**** **College Examination Committee**: The College Examination Committee shall consist of not more than 10 members, nominated by the Principal / Head of the Institute. One of the members shall be the Chairman of the Committee. The Committee will act as the custodian and shall be In-charge of all the matters pertaining to the Internal Assessment, Semester End Examination of regular as well as ex-students for all the examination at Semester I to IV and for the Internal Assessment for Semester V and VI including preparation of time table, setting of the question paper, arrangement for assessment of the answer books, the declaration of the results, attending to and resolving the grievances/queries of the learners which are not part of Unfair Means Inquiry Committee, keeping records of the assessment of all the assessments and examinations, scrutiny of the student's eligible to appear for the additional examination and any other matter pertaining to the conduct of the additional and examination for the ex-students. The committee shall work as per the rules & regulation of the University and under the superintendent of the Principal/ Head of the Institution but as per direction of University Examination authority from time to time.

R.**** **College Unfair Means Inquiry Committee**: The College Unfair Means Inquiry Committee as per the prevailing ordinances of the University. The term of the committee shall be for five years subject to the provision of the Maharashtra Universities Act. The proceedings and working of the committee shall be maintained in the form of documents and minutes.

R.**** **Sets of Question papers**: Three different sets of question papers shall be drawn with the model answer paper and assessment scheme per course for every Semester End Examination one of which shall be used for the regular examination, the second set can be used for the additional examination and the third set can be used for the examination for the ex-student. Similarly two sets of question papers shall be drawn for every test/assignment conducted per course one of which shall be used for the examination and the other for the additional examination.

R.**** **Remuneration to Paper Setters / Examiners / Teaching and Non-**

Teaching Staff: The remuneration payable to the paper setters and examiners will be as prescribed by the University Statute from time to time. The remuneration payable to the teaching and non-teaching staff appointed for the conduct of the examinations will be as per the rates prescribed by the University forthe conduct of the Third Year Examinations by the University in the concerned faculty

R.**** GRACING:** The gracing shall be carried out as per existing ordinances of the University in force

O.*******:** -Grace Marks passing in each head Grace Marks passing in each head each course/ head of passing (Theory/ Practical/ Oral/ Sessional/ TW/ External / Semester End Exam / Internal Assessment) The examinee shall be given the benefit of grace marks

only for passing in each course / head of passing (Theory / Practical / Oral / Sessional/ TW) in External / Semester End Examination or Internal Examination Assessment as follows:

Head of Passing	Grace Marks Upto
Upto - 50	2
051 - 100	3
101 - 150	4
151 - 200	5
201 - 250	6
251 - 300	7
301	8
351	9
401and above	10

Provided that the benefit of such gracing marks given in STATS courses head of passing shall not exceed 1% of the aggregate marks in that examination. Provided further that the benefit of gracing of marks under this Ordinance, shall be applicable only if the candidate passes the entire examination of semester / year. Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE, UGC etc.

O **** Grace Marks for getting Higher Class / Grade**

A candidate/learners who passes in all the subjects / courses and heads of passing in the examination without the benefit of either gracing or condonation rules and whose total number of marks falls short for securing Second Class / Higher Second Class/ First Class or next Higher Grade by marks not more 1% of the aggregate marks of that examination or up to 10 marks, which ever is less, shall be given the required marks to get the next higher or grade as the case may be.

O.****: - Grace Marks for getting Higher Class / Grade**

A candidate/learners who passes in all the subjects / courses and heads of passing in the examination without the benefit of either gracing or condonation rules and whose total number of marks falls short for securing Second Class /
Higher Second Class/ First Class or next Higher Grade by marks not more 1% of the aggregate marks of that examination or up to 10 marks, whichever is less, shall be given the required marks to get the next higher or grade as the case may be.

Provided that benefits of above mentioned grace marks shall not be given, if the candidate fails to secure necessary passing marks in the aggregate course / head of passing also, if prescribed, in the examination concerned.

Provided further that benefits of above mentioned grace marks shall be given to the candidate for such examination/s only for which provision of award of Class / Grade has been prescribed.

Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O.**Grace Marks for getting distinction / Grade 'O' in the subject / course only**.
A candidate/learners who passes in all the Courses or Subjects/ Heads of passing in the examination without benefit of either gracing or condonation rules and whose total number of marks in the courses/ subject/s falls short by not more than three marks for getting Grade 'O'/ distinction in the courses / subject/s respected shall be given necessary grace marks up to three (03) in maximum two subjects, courses subject to maximum 1% of the total marks of that Head of Passing whichever is more, in a given examination.
Provided that benefits of above mentioned grace marks shall not be given to the candidate only for such examination/s for which provision for distinction in a course /subject has been prescribed.

Provided further that this gracing is concurrent with the rules and guidelines of professional statutory bodies at the All India level. such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O. *** Condonation**
If a candidate/learners fails in only one course/ head of passing, having passed in all other courses/ heads of passing, his/her deficiency of marks in such head of passing may be condoned by not more than 1% of the aggregate marks of the examination or 10% of the total number of marks of that course / head of passing in which he/she is failing, whichever is less. However condonation, whether in one head of passing or aggregate head of passing be restricted to maximum up to 10 marks only.

Condonation of deficiency of marks be shown in the Grade Card/ Statement of Marks in the form of asterisk and Ordinance number. Provided that this condonation of marks is concurrent with the rules and guidelines of professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, CCIH, NCTE etc.

O.*** Moderation**

1. The Moderation System shall be application to all the faculties for Under Gradate and Post Graduate Semester End Examination / External Theory Examination.

2.100% moderation of the answer book shall be carried out in the case of candidates failing by 10% of marks of the aggregate marks of that course / paper.

3. In case of STATS course, 100% moderation shall be carried out in case of candidates obtaining 70% and above marks or Grade 'O'.

4. The moderation of answer books of at least 5% of total number of candidates obtaining marks between Grade ‘E’ / minimum passing marks and marks
required for Grade ‘A’ and above First Class/ distinction shall be carried out on random sample basis.

5. One moderator shall be appointed per five examiners. However Chairman, Board of paper setters will act as the moderator, where there are less than five examiners.

6. Moderation work shall be carried out simultaneously with the central assessment of answer books at CAPs.

7. Where marks awarded by the moderator vary from those awarded by original examiner, the marks awarded by the moderator shall be taken as final.

8. University shall formulate detailed scheme of moderation on the basis of guidelines given above.

O.****: Vigilance Squad**

1. The Vigilance Squad/s of not less than three and not more than four members shall be appointed by the Vice Chancellor to visit the Centres of University Examinations to:

i. Ensure that the University Examinations are conducted as per norms laid down.

ii. Observe whether the Senior Supervisors and Block Supervisors are following scrupulously instructions for conduct of the University Examinations.

iii. Check the students who try to resort to malpractices at the time of University Examinations and report such case to the University.

2. The Vigilance Squad is authorized to visit any Examination Centre without prior intimation and enter office of the In -charge of the
and other material relating to the conduct of Examination. They can enter in any block of Examination for checking the candidates identify card, fee receipt, hall tickets etc. to ascertain the authenticity of the Candidate. The Vigilance Squad shall e authorized to detect use of malpractices and unfair means in the University Examination.

3. The Vice Chancellor shall appoint Vigilance Squad which may include: Senior Teachers of Affiliated College/Recognized Institution/ University Departments /Teachers and desirably one lady teacher; and any other person as the Vice Chancellor considers appropriate.

4. The Chairman of Vigilance Squad/s shall submit the report on surprise visit directly to the Vice Chancellor with a copy to the concerned Principal. The Vigilance Squad/s may make suggestions in the matter of proper conduct of examinations, if necessary.

5. The Principal of the College where the centre of examination is located shall be responsible for the smooth conduct of examination. He/ She shall ensure strict vigilance against the use of unfair means by the students and shall be responsible for reporting such cases to the University as well as the law of enforcing authority.

O. ******Amendments of Results

1)**Due To Errors** In any case where it is found that the result of an examination has been affected by errors, the Controller of Examinations shall have power to amend such result in such manner as shall be in accordance with the true position and to make such declaration as is necessary, with the necessary approval of Vice Chancellor, provided the errors are reported / detected within 6 months from the date declaration of results. Errors detected thereafter shall be placed before the Board of Examinations.
Error Means: -
i) Error in computer/data entry, printing or programming and the like.

ii) Clerical error, manual or machine, in totaling or entering of marks on ledger/register.

iii) Error due to negligence or oversight of examiner or any other person connected with evaluation, moderation and result preparation.
2. Due to fraud, malpractices etc.
In any case where the result of an examination has been ascertained and published and it is found that such result has been affected by any malpractices, fraud or any other improper conduct whereby an examinee has
benefited and that such examinee, has in the opinion of the Board of Examination been party of privy to or connived at such malpractice, fraud or improper conduct, the Board of Examination shall have power at any time notwithstanding the issue of the Certificate or the award of a Prize or Scholarship, to amend the result of such examinee and to make such declaration as the Board of Examination considers necessary in that behalf

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