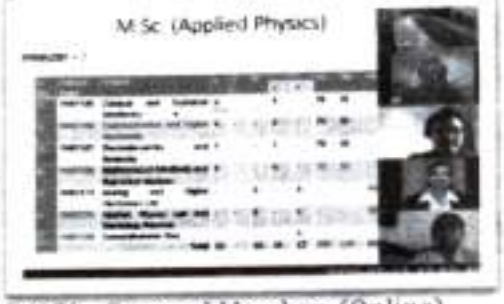
SHRI G S INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE

DEPARTMENT OF APPLIED PHYSICS & OPTOELECTRONICS

Date : 17th July 2020

Minutes of the meeting of Board of Studies held on 17th July 2020 at 12.30 pm

Meeting of Board of Studies (BOS) of Department of Applied Physics & Optoelectronics was held on 17th July 2020 at 12.30 pm in the board room of the department.



Following members attended the meeting:

1.	Dr. (Mrs.) S. Kumbhaj	Chairman
2.	Dr. J. T. Andrews	Member
3.	Ms. Nidhi Oswal	Member (Online)
4.	Mr. Gireesh G. Soni	Member
5.	Dr. Pragya Ojha	Member
6.	Dr. Vipin Kaushik	Member (Online)
7.	Dr. Abhay Kumar	Prof. & Head, SOE, DAVV - External Member (Online)
8.	Dr. Purnima S. Khare	Prof. & Head, DNT, RGTU - External Member (Online)
9.	Dr. Hitesh Mehta	MD, Fiber Optica Tech. - External Member (Online)
10.	Dr. J. W. Dadge (online)	Asst. Prof., Dept. Physics, COE-Pune, Special Invitee

Looking into the current Covid-19 advisory, the BOS meeting was also hosted on Zoom meeting platform. The Chairman welcomed the new members of BOS. The deliberations of the meeting are as follows:

Agenda 1: To review and revise the scheme and syllabus of M.Sc. course, if needed.
Agenda 2: To review and revise the scheme and syllabus of M.Tech. course, if needed.
Agenda 3: To review and revise the scheme and syllabus of B.E. 1st Year course, if needed.

I. M.Sc. (Applied Physics)

a) Since, various corrections were introduced in the previous BOS, internal members did not propose any modifications.
b) The external members were satisfied quality content of the M.Sc. (Applied Physics) courses.
c) Dr Abhay Kumar, bring to the notice that the total credits are reduced by DAVV in its recent ordinance. Accordingly, he suggested to reduce the credits to the PG final semester project (28 credit). The chairman explained that, since it is a common scheme for all three MSc programs, it will be discussed in the Academic Council. (Existing Scheme of Semester -IV is enclosed as annexure – 1)

II. M.Tech. (Optoelectronics)

As per the suggestions proposed by the external members following changes are proposed;

a) Looking to the current scenario of optical communication networks, the courses on Optical Communications System (OCS) and Optical Network are updated. As the changes are less than 5%, the subject code shall remain same. (New and Old syllabus are enclosed as Annexure 2a & 2b and 3a & 3b)

b) It was discussed and proposed that the course OCS shall be a compulsory course instead of an elective, accordingly the compulsory course Advanced Fiber Optics is moved to the list of electives. The name of course on Integrated Optics to be modified as Optoelectronics Integrated Circuits. The modifications made to the scheme for Second Semester are enclosed as Annexure 4A and 4B. As there are no backlog students, the Subject Code shall remain unchanged.

III. B.E. 1st Year (Physics)

a) As per the suggestions and inputs provided by the external members, changes are added to the course PH10005 (New and Old syllabus are enclosed as Annexure 5a & 5b).

b) The external members also suggested to include Solid State Theory in place of Lasers & Fiber Optics as the students of Electronics, Computer and Electrical Engineering may need at latter time. The members agreed to consider the change in next meeting of BOS.

The session concluded with the vote of thanks to the chair.

Dr. (Mrs.) S. Kumbhaj
Chairman, BOS-Dept. of Appl. Phys. & OE
and Prof. & Head, Dept. of Appl. Phys. & OE
SGSITS, Indore

Annexure 1

Scheme of M.Sc. (Applied Physics)

Semester – IV

S. No.	Subject Code	Subject	L	T	P	Credits		Theory Marks	
						T	P	CW/SW	END
1.	PH97499	Dissertation	-	-	-	-	26	120	180

OE66659 – Optical Communication Systems											
Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
OE66659	Optical Communication Systems	4	-	-	30	70	-	-	4	-	4

Optical Receivers: Devices types, optical detection principle, quantum efficiency, responsivity, semiconductor photodiodes with and without internal gain, phototransistors, photoconductive detectors, noises encountered in channel as well as in receiver, signal-to-noise ratio (SNR) calculations, receiver structures, optical preamplifier and high performance.

System Design: Intensity modulation/ direct detection: Source limitations, equalization, design considerations, digital systems, regenerative repeater, digital optical receiver, bit error rate (BER), eye diagram, link design-power budget, rise time budget, analog systems, direct intensity modulation, subcarrier intensity modulation,

Recent Optical Communication Technologies: Free space optical communication system: Transmission parameters, Sources and detectors for FSO, effect of atmospheric attenuation and turbulence on FSO, terrestrial system. Optical Code Division Multiple Accesses (OCDMA): performance of synchronous OCDMA, optical encoders and decoders, Sub carrier multiplexing systems.

Coherent Optical Communication: Detection principles, practical constraints, modulation formats, demodulation schemes, phase diversity reception, receiver sensitivities, BER, system performance, DPSK field demonstration system, multicarrier system and network concepts.

Transmission System Engineering: System model, power penalty, power penalty associated with transmitter, receiver and optical amplifier, Amplifier spacing penalty, Power transients and automatic gain control, Crosstalk, crosstalk reduction, cascaded filters, wavelength stabilization, Overall design considerations, all-optical networks.

Books & References Recommended:

- H. Kolimbris, Fiber optics communications, Pearson Education, 1/e, 2004.
- J. Gower, Optical communication systems, PHI, 2/e, 2001.
- J.M. Senior, Optical fibre communications, Principles & Practice, (PHI), 2/e, 2004.
- G. P. Agrawal, Fiber-optic communication systems, John Wiley & sons, Inc., 3/e, 2002.
- R. Ramaswami and K. N. Sivarajan, Optical Networks, Morgan Kaufmann Publishers, 2/e, 2002.

OE66659 – Optical Communication Systems											
Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
OE66659	Optical Communication Systems	4	-	-	30	70	-	-	4	-	4

Optical Receivers: Devices types, optical detection principle, quantum efficiency, responsivity, semiconductor photodiodes with and without internal gain, phototransistors, photoconductive detectors, noises encountered in channel as well as in receiver, signal-to-noise ratio (SNR) calculations, receiver structures, optical preamplifier and high performance.

System Design: Intensity modulation/ direct detection: Source limitations, equalization, design considerations, digital systems, regenerative repeater, digital optical receiver, bit error rate (BER), eye diagram, link design-power budget, rise time budget, analog systems, direct intensity modulation, subcarrier intensity modulation, **advanced modulation formats,**

Recent Optical Communication Technologies: Free space optical communication system: Transmission parameters, Sources and detectors for FSO, effect of atmospheric attenuation and turbulence on FSO, terrestrial system. Optical Code Division Multiple Accesses (OCDMA): performance of synchronous OCDMA, optical encoders and decoders, Sub carrier multiplexing systems.

Coherent Optical Communication: Detection principles, practical constraints, modulation formats, demodulation schemes, phase diversity reception, receiver sensitivities, BER, system performance, DPSK field demonstration system, multicarrier system and network concepts.

Transmission System Engineering: System model, power penalty, power penalty associated with transmitter, receiver and optical amplifier, Amplifier spacing penalty, Power transients and automatic gain control, Crosstalk, crosstalk reduction, cascaded filters, wavelength stabilization, Overall design considerations, all-optical networks.

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- G. P. Agrawal, Fiber-optic communication systems, John Wiley & sons, Inc., 3/e, 2002.
- R. Ramaswami and K. N. Sivarajan, Optical Networks, Morgan Kaufmann
- Publishers, 2/e, 2002.

Annexure 3A

OE66658 – Optical Networks

Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
OE66658	Optical Networks	4	-	-	30	70	-	-	4	-	4

- **Introduction to Optical Networks:** First generation optical networks, multiplexing techniques, second generation optical networks, virtual circuit services and datagrams, transparency of regenerators, Broadcast and Select Networks: Topologies for broadcast networks, bus, star, ring and mesh topology, MAC protocols, throughput calculation, synchronization, aloha and slotted aloha, testbeds, lambda net, rainbow and starnet.
- **WDM networks and components** : WDM networks, DWDM, CWDM, WDM multiplexers and demultiplexers, Arrayed waveguide grating, optical add/drop multiplexers, fiber Bragg gratings as add/drop multiplexers, WDM Filters, Fabry Perot filters, acousto-optic tunable filters, switching technologies and architectures, characterization of switches.
- **First Generation Optical Networks:** SONET/SDH, Goals of SONET designs, SONET frame structure, overhead channels, payload pointer, Virtual tributaries, multiplexing hierarchy, elements of SONET/SDH infrastructure, FDDI, ATM, IP, layered architecture, physical layer, data link layer, network layer, transport layer.
- **Wavelength Routing Networks:** Classification of light paths, The Optical layer, Wavelength Cross Connects (WXC) wavelength reuse, node design, degree of wavelength conversion, Static and reconfigurable network, N/W design considerations; fiber cost trade-off,
- **Photonic Packet Switching:** Optical time domain multiplexing (OTDM), methods of multiplexing and demultiplexing, broadcast OTDM networks, bit interleaving and packet interleaving, optical AND gates, nonlinear optical loop mirrors, terahertz optical asymmetric demultiplexer, switch based networks, deflection routing.

Books & References Recommended :

- R. Ramaswami and K. N. Sivarajan, Optical Networks : A Practical Perspective, Harcourt Asia P. Ltd. 1999.
- C. S. R. Murthy and M. Gurusamy, WDM Optical Networks, Prentice Hall, 2002.
- A.S. Tanenbaum, Computer Networks, Prentice Hall of India Pvt. Ltd., 2002.
- J.E. Midwinter, Photonics in Switching, Academic Press, 1993.

Annexure 3B

OE66658 – Optical Networks

Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
OE66658	Optical Networks	4	-	-	30	70	-	-	4	-	4

- **Introduction to Optical Networks:** First generation optical networks, multiplexing techniques, second generation optical networks, virtual circuit services and datagrams, transparency of regenerators, Broadcast and Select Networks: Topologies for broadcast networks, bus, star, ring and mesh topology, MAC protocols, throughput calculation, synchronization, aloha and slotted aloha, testbeds, lambda net, rainbow and starnet.
- **WDM networks and components :** WDM networks, DWDM, CWDM, WDM multiplexers and demultiplexers, Arrayed waveguide grating, optical add/drop multiplexers, fiber Bragg gratings as add/drop multiplexers, WDM Filters, Fabry Perot filters, acousto-optic tunable filters, Optical connectors, switching technologies and architectures, characterization of switches.
- **First Generation Optical Networks:** SONET/SDH, Goals of SONET designs, SONET frame structure, overhead channels, payload pointer, Virtual tributaries, multiplexing hierarchy, elements of SONET/SDH infrastructure, **SDH Frame, SDH Frame overheads, SDH tributary units,** FDDI, ATM, IP, layered architecture, physical layer, data link layer, network layer, transport layer.
- **Wavelength Routing Networks:** Classification of light paths, The Optical layer, Wavelength Cross Connects (WXC) wavelength reuse, node design, degree of wavelength conversion, Static and reconfigurable network, N/W design considerations; fiber cost trade-off, **Optical Transport Networking (OTN) protocol**.
- **Photonic Packet Switching:** Optical time domain multiplexing (OTDM), methods of multiplexing and demultiplexing, broadcast OTDM networks, bit interleaving and packet interleaving, optical AND gates, nonlinear optical loop mirrors, terahertz optical asymmetric demultiplexer, switch based networks, deflection routing.

Books & References Recommended :

- R. Ramaswami and K. N. Sivarajan, Optical Networks : A Practical Perspective, Harcourt Asia P. Ltd. 1999.
- C. S. R. Murthy and M. Gurusamy, WDM Optical Networks, Prentice Hall, 2002.
- A.S. Tanenbaum, Computer Networks, Prentice Hall of India Pvt. Ltd., 2002.
- J.E. Midwinter, Photonics in Switching, Academic Press, 1993.
- **U. Black, Optical Networks, Prentice Hall, 2002.**

SEMESTER-II (Existing)

Annexure 4A

S. No	Code No.	Subject	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
								TH	CW	SW	Pr.	Total
1.	OE66503	Integrated Optics	4	-	-	4	-	70	30	-	-	100
2.	**OE66504**	**Advanced Fiber Optics**	4	-	-	4	-	70	30	-	-	100
3.	OE66508	Optical Networks	4	-	-	4	-	70	30	-	-	100
4.		Elective-II	4	-	-	4	-	70	30	-	-	100
5.		Elective-III	4	-	-	4	-	70	30	-	-	100
6.	OE66851	Optical Communication Laboratory	-	-	4	-	4	-	-	40	60	100
7.	OE66852	Optoelectronics Integrated Circuits and Nanophotonics Laboratory	-	-	4	-	4	-	-	40	60	100
8.	OE66881	Seminar	-	-	2	-	2	-	-	100	-	100
	OE66900	Comprehensive Viva									Grade	Grade
		Total	20		10	20	10	350	150	180	120	800

Elective-II

OE66509 - Optical Communication System

EI69702 - Microwave Integrated Circuits

EC65752 - Microwave Measurement & Design

Elective-III

OE66505 - Nanophotonics

EE69505 - Digital Signal Processing

EC65502 - Mobile and Satellite Communication

SEMESTER-II (Proposed)

Annexure 4B

S. No	Code No.	Subject	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
								TH	CW	SW	Pr.	Total
1.	**OE66503**	**Optoelectronics Integrated Circuits**	4	-	-	4	-	70	30	-	-	100
2.	**OE66509**	**Optical Communication System**	4	-	-	4	-	70	30	-	-	100
3.	OE66508	Optical Networks	4	-	-	4	-	70	30	-	-	100
4.		Elective-II	4	-	-	4	-	70	30	-	-	100
5.		Elective-III	4	-	-	4	-	70	30	-	-	100
6.	OE66851	Optical Communication Laboratory	-	-	4	-	4	-	-	40	60	100
7.	OE66852	Optoelectronics Integrated Circuits and Nanophotonics Laboratory	-	-	4	-	4	-	-	40	60	100
8.	OE66881	Seminar	-	-	2	-	2	-	-	100	-	100
	OE66900	Comprehensive Viva									Grade	Grade
		Total	20		10	20	10	350	150	180	120	800

Elective-II

OE66504 - Advanced Fiber Optics

EI69702 - Microwave Integrated Circuits

EC65752 - Microwave Measurement & Design

Elective-III

OE66505 - Nanophotonics

EE69505 - Digital Signal Processing

EC65502 - Mobile and Satellite Communication

Annexure – 5A

PH10006 – Physics

Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
PH10006	Physics	3	1	2	30	70	20	30	4	1	5

COURSE OBJECTIVES

CO #1 *To provide knowledge and understanding capacity of basic, applied and modern physics.*
CO #2 *To generate attitude and interest to solve problems at macro, micro to nanoscale level systems.*
CO #3 *To update the knowledge of physics tools, instruments and techniques.*
CO #4 *To identify, conduct, formulate and solve engineering problems with the basics and applied knowledge of Physics.*

COURSE CONTENTS

Unit-1. Electromagnetic Waves Propagation *: Introduction, wave packets, Phase and group velocity, wave equation, Gradient, scalar, divergence and curl; physical meaning, Gauss and Stoke's theorems, Maxwell's equations, em wave equations for plane waves in dielectric medium and free space, relation among E, B and k, Poynting theorem.*

Unit-2. Optics: *Principle of superposition. Conditions for sustained interference, Division of wavefront and amplitude, Newton's rings. Fresnel and Fraunhofer class of diffraction, diffraction at single slit, double and N (grating) slits. Rayleigh's criteria and resolving power.*

Unit-3. Quantum Theory : *Planck's radiation formula, Ultraviolet catastrophe, Compton's effect, de Broglie's concept of matter waves, Heisenberg's uncertainty relations, Schrodinger's wave equation, Physical interpretation of wave function, Particle in a one-dimensional potential well.*

Unit-4. Lasers: *Spontaneous and Stimulated emission, components of lasers, optical resonator, Einstein's A & B coefficients, Population inversion, Ruby and He-Ne lasers, applications.*

Unit-5. Fiber Optics : *Classification, acceptance angle, numerical aperture, V-number, attenuation, ray dispersion in fibers, fiber optics sensors, optical fiber communication system.*

Text Books

1. N. Subramanyam and B. Lal : A Text book of Optics, (S. Chand, New Delhi) 2010.
2. A. Beiser, S. Mahajan, S. R. Choudhary : Concepts of Modern Physics, 6th Edition,(SIE, Tata-McGraw-Hill, New Delhi) 2012.
3. A. Ghatak : Optics, 4th Edition, (Tata McGraw-Hill, New Delhi) 2009.

Reference books

4. H. K. Malik and A. K. Singh : Engineering Physics (Tata McGraw Hill New Delhi) 2010.
5. R.P. Feynman, R.B. Leighton and M.Sands : Feynman Lectures on Physics Vol. 1 -3 (Addison-Wesley, Delhi 1995).
6. W.H. Hayt : Engineering Electromagnetic, 5th Ed. (Tata-McGraw Hill, New Delhi) 1995.
7. M.N.O. Sadiku : Elements of Electromagnetic, 3rd Ed. (Oxford Press, New Delhi) 2000.

Annexure 58

PH10006 – Physics

Subject Code	Subject Nomenclature	Contact hrs			Maximum Marks				Credits		
		L	T	P	CW	End	SW	End	T	P	Tot
PH10006	Physics	3	1	2	30	70	20	30	4	1	5

COURSE OBJECTIVES

CO #1 *To provide knowledge and understanding capacity of basic, applied and modern physics.*
CO #2 *To generate attitude and interest to solve problems at macro, micro to nanoscale level systems.*
CO #3 *To update the knowledge of physics tools, instruments and techniques.*
CO #4 *To identify, conduct, formulate and solve engineering problems with the basics and applied knowledge of Physics.*

COURSE CONTENTS

Unit-1. Electrodynamics & STR: *Gradient, divergence and curl; significance. Maxell's equations, em wave equations for plane waves in dielectric medium and free space, Poynting theorem; postulates, time dilation length contraction, twin paradox, mass-energy relation.*

Unit-2. Optics: *Principle of superposition. Conditions for sustained interference, Division of wavefront and amplitude, Newton's rings. Fresnel and Fraunhofer class of diffraction, diffraction at single slit, double and N (grating) slits. Rayleigh's criteria and resolving power.*

Unit-3. Quantum Theory : *Planck's radiation formula, Ultraviolet catastrophe, Compton's effect, de Broglie's concept of matter waves, Heisenberg's uncertainty relations, Schrodinger's wave equation, Physical interpretation of wave function, Particle in a one-dimensional potential well.*

Unit-4. Lasers: *Spontaneous and Stimulated emission, components of lasers, optical resonator, Einstein's A & B coefficients, Population inversion, Ruby and He-Ne lasers, applications.*

Unit-5. Fiber Optics: *Classification, acceptance angle, numerical aperture, V-number, attenuation, ray dispersion in fibers, fiber optics sensors, optical fiber communication system.*

Text Books

1. N. Subramanyam and B. Lal : A Text book of Optics, (S. Chand, New Delhi) 2010.
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3. A. Ghatak : Optics, 4th Edition, (Tata McGraw-Hill, New Delhi) 2009.

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5. R.P. Feynman, R.B. Leighton and M.Sands : Feynman Lectures on Physics Vol. 1 -3 (Addison-Wesley. Delhi 1995).
6. W.H. Hayt : Engineering Electromagnetic, 5th Ed. (Tata-McGraw Hill, New Delhi) 1995.
7. M.N.O. Sadiku : Elements of Electromagnetic, 3rd Ed. (Oxford Press, New Delhi) 2000.

COURSE OUTCOME

At the end of one-semester course, the students are armed with
CO #1 *The knowledge of multiphysics to understand engineering problems*
CO #2 *The skills to use logic and attitude towards engineering problems with multiphysics implementation.*
CO #3 *The ability use modern engineering physics techniques and tools including software.*