Minutes of the urgent meeting (20th meeting) of the Senate held on 23rd July 2007 in the Senate Hall of the Institute.

The following were present: -

1. Prof. S.C. Saxena, Director - Chairman
2. Prof. H.K. Verma, Dy. Director
3. Prof. B.M.J. Periera (Biotechnology)
4. Prof. R.P. Singh (Biotechnology)
5. Prof. I.M. Mishra (Chemical Engg.)
6. Prof. Bikash Mohanty (Chemical Engg.)
7. Prof. Shri Chand (Chemical Engg.)
8. Prof. Vijay Kumar Agarwal (Chemical Engg.)
9. Prof. G. Bhattacharjee (Chemistry)
10. Prof. R.N. Goyal (Chemistry)
11. Prof. Kamaluddin (Chemistry)
12. Prof. V.K. Gupta (Chemistry)
13. Prof. A.K. Singh (Chemistry)
14. Prof. G.L. Asawa (Civil Engineering)
15. Prof. N.M. Bhandari (Civil Engineering)
16. Prof. S.S. Jain (Civil Engineering)
17. Prof. (Mrs) Renu Bhargava (Civil Engineering)
18. Prof. P.K. Garg (Civil Engineering)
19. Prof. D.K. Paul (Earthquake Engg.)
20. Prof. Ashwani Kumar (Earthquake Engg.)
21. Prof. H. Sinvhal (Earth Sciences)
22. Prof. R.P. Gupta (Earth Sciences)
23. Prof. V.N. Singh (Earth Sciences)
24. Prof. A.K. Awasthi (Earth Sciences)
25. Prof. A.K. Pachauri (Earth Sciences)
26. Prof. D.K. Mukhopadhyay (Earth Sciences)
27. Prof. Rathina Anbalagan (Earth Sciences)
28. Prof. R.G.S. Sastry (Earth Sciences)
29. Prof. H.O. Gupta (Electrical Engg.)
30. Prof. Vinod Kumar (Electrical Engg.
31. Prof. Pramod Agarwal (Electrical Engg.)
32. Prof. D.K. Mehra (E. & C. Engg.)
33. Prof. S.N. Sinha (E. & C. Engg.)
34. Prof. Padam Kumar (E. & C. Engg.)
35. Prof. N.K. Goel (Hydrology)
36. Prof. Pashupati Jha (Hum. & Soc. Sc.)
37. Prof. (Mrs) Renu Rastogi (Hum. & Soc. Sc.)
38. Prof. Sukhpal Singh (Hum. & Soc. Sc.)
39. Prof. A.K. Ray (Paper Technology)
40. Prof. Satish Kumar (Paper Technology)
41. Prof. G.S. Srivastava (Mathematics)
42. Prof. (Mrs.) R.R. Bhargava (Mathematics)
43. Prof. S.P. Sharma (Mathematics)
44. Prof. (Mrs.) Rama Bhargava (Mathematics)
45. Prof. R.C. Mittal (Mathematics)
46. Prof. V.K. Katiyar (Mathematics)
47. Prof. Y.K. Gupta (Mathematics)

48. Prof. Sunita Gakkhar (Mathematics)
49. Prof. Satish C. Sharma (Mech. & Indl. Engg.)
50. Prof. Dinesh Kumar (Mech. & Indl. Engg.)
51. Prof. P.K. Jain (Mech. & Indl. Engg.)
52. Prof. Akhilesh Gupta (Mech. & Indl. Engg.)
53. Prof. B.K. Gandhi (Mech. & Indl. Engg.)
54. Prof. B.K. Mishra (Mech. & Indl. Engg.)
55. Prof. Satya Prakash (Met. & Mat. Engg.)
56. Prof. R.D. Agarwal (Met. & Mat. Engg.)
57. Prof. S. Ray (Met. & Mat. Engg.)
58. Prof. S.K. Nath [Met. & Mat. Engg.)
59. Prof. Ishwar Singh (Physics)
60. Prof. Jagdish Rai (Physics)
61. Prof. G.S. Singh (Physics)
62. Prof. Vir Singh (Physics)
63. Prof. S.K. Tripathi (W.R.D. & M.)
64. Prof. Ashwani K. Chaudhary (Institute Instrumentation Centre)
65. Mr. Arun Kumar, Head, AHEC
66. Dr. R.P. Maheshwari, Assoc. Professor, Electrical Engineering
67. Dr. Rashmi Gaur, Assoc. Professor, Humanities & Social Sciences
68. Dr. M.R. Maurya, Assoc. Professor, Chemistry
69. Dr. Manoj Arora, Assoc. Professor, Civil Engineering
70. Dr. Ajay Gairola, Assoc. Professor, Civil Engineering
71. Lt.Col. (Retd.) A.K. Srivastava, Registrar - Secretary

The Chairman welcomed the members to the urgent meeting (20th meeting) of the Senate.

The Senate welcomed the under- mentioned new members and hoped for their valuable contribution and active participation in its functioning:

1. Prof. Ramesh Chandra Agarwala
   Department of Metallurgical & Materials Engineering

2. Prof. Sukh Pal Singh, Department of Humanities & Social Sciences

3. Prof. Vijay Kumar Agarwal, Department of Chemical Engineering

4. Prof. Akhilesh Gupta
   Department of Mechanical & Industrial Engineering

5. Prof. B.K. Gandhi, Department of Mechanical & Industrial Engineering

6. Prof. Bhanu Kumar Mishra
   Department of Mechanical & Industrial Engineering

7. Prof. Sajjan Pal Singh, Department of Electrical Engineering

8. Prof. Manoj Mishra, Department of Electronics & Computer Engineering

Communications were received from the following members of the Senate for not attending the meeting:

1. Prof. H.C. Gupta, IIT Delhi
2. Prof. Narendra K. Sharma, IIT Kanpur
3. Prof. A.K. Jain, Department of Physics
4. Prof. Ravi Bhushan, Department of Chemistry
5. Prof. S.P. Gupta, Department of Electrical Engineering
6. Prof. B.D. Indu, Department of Physics

The agenda was then taken up.

Item No. 20.1: To consider the syllabi to be taught in II year of 5 year Integrated M.Sc./M.Tech. programmes and some new Institute electives.

As considered and recommended by the Board, UGS, the Senate decided that the following syllabi to be taught in IInd year of 5 year Integrated M.Sc./M.Tech. programmes and some new Institute electives as given at **Appendix 'A'** be approved:

1.	PH-201M	Course Title: Optics
2.	PH-211	Course Title: Special Theory of Relativity
3.	PH-202M	Course Title: Electricity and Magnetism
4.	PH-212	Course Title: Thermal Physics
5.	CY-201M	Course Title: Physical Chemistry-1
6.	CY-211M	Course Title: Inorganic Chemistry
7.	CY-202M	Course Title: Organic Chemistry-1
8.	CY-212	Course Title: Basics of Analytical, Nano and Green Chemistry
9.	MA-201M	Course Title: Complex Analysis and Partial Differential Equations
10.	MA-202M	Course Title: Numerical Analysis
11.	MA-203	Course Title: Mechanics-I
12.	MA-204	Course Title: Linear Algebra
13.	IHS-14	Course Title: Fiction of the Indian Diaspora
14.	IHS-15	Course Title: Creative Writing in English
15.	IHS-16	Course Title: Linguistics
16.	IHS-74	Course Title: Environmental Economics

Item No. 20.2: To consider the report of the Sub-Committee constituted to re-examine all the programmes.

After discussion, the Senate decided that the guidelines for framing the curriculum structure for various B.Tech., IDD and Integrated Programmes as given at **Appendix 'B'** be approved.

Item No. 20.3: To consider the report of the Committee constituted to frame the proposal for visit of International Students for short duration.

After discussion, the Senate decided that the guidelines for framing proposals for visit of International Students for short duration as given at **Appendix 'C'** be approved.

Item No. 20.4: To consider the Prizes/Awards for students.

After discussion, the Senate decided that the prizes/ awards for students be awarded at the existing minimum rates out of the existing donation amount till it is exhausted.

Item No.20.5: To report the Standing Orders for students and procedure for enquiries and punishments.

The Senate noted the Standing Orders for students and Procedure for Enquiries and Punishments as approved by the Director (Chairman, Senate) on behalf of the Senate and decided that the same be implemented from the date of the approval by the Director (Chairman, Senate) for current Academic year.

The Senate further decided that the Standing Orders for Students and Procedure for Enquiries and Punishments be re-examined thoroughly in view of the suggestions given by the members on the floor and the same be placed before the Senate for consideration.

Item No.20.6: To consider the Organizations/Institutions for recognition as Research Centres for the purpose of pursuing Ph.D. as Part time.

As considered and recommended by the Board, PGS&R, the Senate decided that the following Organizations / Institutions be recognized as Research Centres for the purpose of pursuing Ph.D. as Part Time in the Institute:

Name of Organizations/ Institutions	**Deptt/Centre Eligible to regular candidate**	**Appendix**
Human Resource Development Centre (a unit of CSIR), Ghaziabad	Humanities and Social Sciences and Management	A

	Studies	
CMRI Roorkee (Central Institute of Mining and Fuel Research, Roorkee), Regional Centre, CBRI Campus, Roorkee of CMRI Dhanbad	Civil / Earthquake / Earth Sciences	B
Station Health Organization, (Large) Roorkee	Humanities and Social Sciences and Management Studies	C
Bhaba Atomic Research Centre (DAE), Mumbai	All Deptts. / Centres	D

Item No. 20.7: To consider report of committee constituted regarding issues of the MHRD working Group on Technical Education.

After discussion, the Senate decided that the report of committee constituted regarding issues of the MHRD working Group on Technical Education as given at **Appendix 'D'** be approved.

UNDER ANY OTHER ITEM:

Item No. 20.8: To consider the syllabi of PH-101 (Physics I), PH-201 (Physics II) and MT-201 B (Material Science B).

After discussion, the Senate decided that the syllabi of PH-101 (Physics I), PH-201 (Physics II) and MT-201 B (Material Science B) as given at **Appendix 'E'** be approved.

The meeting ended with a vote of thanks to the Chair.

Appendix 'A'
Item No.Senate/20.1

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code : **PH-201M** Course Title: **Optics**

2. Contact Hours: L: 3 ; T: 1 ; P: 2 ;

3. Examination Duration (Hrs.): Theory 0 3 Practical 0 0

4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PRE 00

5. Credits: 05 6. Semester: Autumn Spring Both

7. Pre-requisite: PH-101 8. Subject Area: BSC

9. **Objective of Course:** To expose students to the concepts of waves, oscillations and elements of optics i.e. interference, diffraction and polarization.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Waves and Oscillations:** Simple harmonic motion, damped oscillations, forced vibrations, origin of refractive index, wave packet, group velocity of a wave packet, pulse dispersion, wave propagation, energy transport in wave motion, 1-D wave equation and its general solution, stationary light waves, Ives and Wiener's experiments.	9
2.	**Geometrical optics**: Fermat's principle, the ray equation and its solutions, matrix method in paraxial optics, unit planes, nodal planes, system of thin lenses.	6
3.	**Interference:** Huygen's principle and its applications, interference by division of wavefront, two slit interference, Fresnel's Biprism, interference with white light, displacement of fringes, interference by division of amplitude, thin parallel films, antireflection coatings, wedge shaped films, Newton's rings, Michelson interferometer and its applications, multiple beam interference, Fabry Perot interferometer and etalon.	8
4.	**Diffraction:** Fraunhofer diffraction, single, double and multiple slit diffraction, diffraction grating, diffraction at a circular aperture, Fresnel diffraction, Fresnel half period zones, the zone plate, diffraction at a straight edge, diffraction of a plane wave by a long narrow slit and transition to Fraunhofer region.	9
5.	**Polarization:** Polarization and double refraction, production of polarized light, Brewster's law, Malus's law, double refraction, interference of polarized light, quarter and half wave plates, analysis of polarized light, optical activity, polarimeters, Laurent's half shade and biquartz polarimeters, Wollaston prism, Rochon prism, plane wave propagation in anisotropic medium, ray velocity and ray refractive index, Faraday rotation.	10
	Total	42

6

List of experiments:

i. Determination of wavelength of sodium light by Fresnel biprism.
ii. Determination of Young's modulus of a glass plate by Cornu's method.
iii. Determination of wavelength of laser light by Fabry Perot etalon.
iv. Normal dispersion curves and Cauchy's relations.
v. Fresnel equations: rotation of plane of polarization by reflection.
vi. Study of single, double and multiple slit diffraction.
vii. Study of diffraction of light by a thin wire.
viii. Determination of wavelength of light by Diffraction grating.
ix. Production and analysis of polarized light using quarter wave plates.
x. Nodal Slide Experiment.
xi. Δλ by Michelson Interferometer
xii. Thickness of Mica sheet by Michelson Interferometer

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	A. K. Ghatak, **Optics**. Tata McGraw Hill , 3rd Ed	2003
2.	Eugene Hecht ,**Optics**. . Addison Wesley, 4th Ed	2001
3.	F. A. Jenkins, H. E. White,**Fundamentals of Optics** , McGraw Hill New York	1976

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **PH-211** Course Title: **Special Theory of Relativity**

2. Contact Hours: L: 2 ; T: 1 ; P: 0 :

3. Examination Duration (Hrs.): Theory 0 2 Practical 0 0

4. Relative Weightage: ***CWS*** 2 5 ***PRS*** 0 0 ***MTE*** 2 5 ***ETE*** 5 0 ***PRE*** 0 0

5. Credits: 0 3 6. Semester: Autumn Spring Both

7. Pre-requisite: PH-101 8. Subject Area: DCC

9. Objective of Course: The course aims to familiarize students with the special theory of relativity.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Relativistic Kinematics:** Attempts to Locate the Absolute Frame: the Michelson-Morley Experiment, The Relativity of Simultaneity, Derivation of the Lorentz Transformation Equations, Some Consequences of the Lorentz Transformation Equations, A More Physical Look at the Main Features of the Lorentz Transformation Equations, The Observer in Relativity, The Relativistic Addition of Velocities, Aberration and Doppler Effect of Relativity	6
2.	**Relativistic Dynamics:** Mechanics and Relativity, Relativistic Momentum, Alternative Views of Mass in Relativity, The Relativistic Force Law and the Dynamics of a Single Particle, The Equivalence of Mass and Energy, The Transformation Properties of Momentum, Energy, Mass and Force	6
3.	**Relativity and Electromagnetism:** The Interdependence of Electric and Magnetic Fields, The Transformation for E and B, The field of a Uniformly Moving Point Charge, Forces and Fields near a Current-Carrying Wire, Forces between Moving Charges, The Invariance of Maxwell's Equations, The Possible Limitations of Special Relativity	6
4.	**The Geometric Representation of Space-Time** ***The Twin Paradox*** ***The Principle of Equivalence and General Relativity***	6
5.	**Four-Vectors and Relativistic Invariance:** Vectors and Transformations, Rotation about the Z axis, Invariants of a Transformation, The Transformation Properties of Physical Law, Scalar invariants, Minkowski Space and Four-Vectors, The Momentum-Energy Four-Vector	4
	Total	28

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	Resnick R.-Introduction to Special Relativity- Wiley Eastern	1986
2.	D. Kleppner and R.J. Kolenkow -An Introduction to Mechanics, McGraw Hill	1999
3.	Anadijiban Das, The Special Theory of Relativity, Springer Verlag	1993

8

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **PH-202M** Course Title: **Electricity and Magnetism**

2. Contact Hours: L; 3 ; T; 1 ; P; 2 ;

3. Examination Duration (Hrs.): Theory 0 3 Practical 0 0

4. Relative Weightage: ***CWS*** 15 ***PRS*** 15 ***MTE*** 30 ***ETE*** 40 ***PRE*** 00

5. Credits: 05 6. Semester: Autumn / Spring / Both

7. Pre-requisite:PH -101 8. Subject Area: BSC

9. **Objective of Course:** The course aims to familiarize students with the elements of Electricity and Magnetism.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Electrostatics:** Charge distributions, potential, two dimensional potential problem, electric field, Gauss's law with examples, electrostatic energy, Laplace equation (boundary value problems), method of images, multipole expansion, dielectrics, polarization, electric displacement vector dielectric susceptibility, force on dielectrics, Clausius-Mossotti equation, boundary conditions.	15
2.	**Magnetostatics:** Biot-Savart law, Ampere's law, magnetic scalar and electric vector potentials, multipole expansion, dia-, para- and ferromagnetism, magnetic susceptibility, boundary conditions.	12
3.	**Electromagnetics:** Faraday's Law of induction, self-inductance, transient currents, magnetic energy and mechanical forces, Maxwell's equations, Plane waves in conducting medium and skin effect, Refraction and reflection of plane waves, Pressure due to radiation and Radiation from an oscillating dipole.	15
	Total	42
	List of Experiments:	
I	To determine the self-inductance of a given coil.	
II	To find the resonant frequency of series LCR circuit.	
III	To obtain hystersis curve (B-H Curve) for a given ferromagnetic material.	
IV	To study transient effect in LCR circuits.	
V	To measure the dielectric constant and dielectric loss of given material by using LCR metre.	
VI	To measure the magnetic flux density in the middle of various wire loops with the Hall probe and to investigate its dependence on the radius and number of turns.	
VII	To measure the magnetic flux density along the axis of long coils and compare it with the theoretical values obtained from Biot-Savart's Law.	
VIII	Comparison of capacities (De-Sauty method)	
IX	Dielectric constant of material by Resonance method	
X	Determination of Inductance by Raleigh method	

9

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	B. Bleaney and Brebis Bleaney; Electricity and Magnetism, Vol. I	1989
2.	D. Griffiths Introduction to Electrodynamics, Prentice Hall.	1999
3.	F M Purcell . Berkeley Physics Course, Vol. II	1994
4.	R P Feynman, RB Leighton, M. Sands,The Feynman Lectures on Physics, Vol. II	1989

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **PH-212** Course Title: **Thermal Physics**
2. Contact Hours: L: 3 ; T: 1 ; P: 2 ;
3. Examination Duration (Hrs.): Theory 0 | 3 Practical 0 | 3
4. Relative Weightage: *CWS* 15 *PRS* 15 *MTE* 15 *ETE* 40 *PRE* 15
5. Credits: 0 | 5 6. Semester: Autumn / Spring / Both
7. Pre-requisite: MI-101 8. Subject Area: BSC
9. **Objective of Course:** The course aims at familiarizing students with laws of thermodynamics and their correspondence with statistical mechanics.
10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Thermodynamic Potentials and Relations:** Characteristic functions, Enthalpy, Helmholtz & Gibb's functions, Maxwell's thermodynamic relations and their applications, Volume expansivity, cubic expansion coefficient and compressibility, Closed & Open systems, Chemical potential, Internal energy equation, Heat capacity equation, Third law of thermodynamics, Equilibrium conditions, Phase Equilibrium, Phase transitions.	12
2.	**Low Temperatures and Third Law:** Joule-Kelvin effect, Liquefaction of gases, Magnetic cooling, Third Law of Thermodynamics and its applications, Phase behaviour of Helium.	08
3.	**Thermodynamics of Radiation:** Thermal Radiation, Radiation in a constant temperature enclosure, Kirchoff's Law, Properties of Black-body radiation, Stefan-Boltzmann Law, Wien's Law, Rayleigh-Jeans Law, Wien's displacement Law, Planck's distribution.	07
4.	**Statistical Mechanics:** Fundamental principles, Equilibrium distribution, phase space, Liouville's theorem, Lagrangian multipliers, ensembles, Partition function, Equipartition of energy, distribution of speeds, Derivation of Classical and quantum statistics, Thermal properties of solids.	15
	Total	42
	Laboratory work related to the course:	
I	Measurement of temperature using thermister.	
II	Specific heat measurements.	
III	Stefan's constant and work function of a photo cathode using incandescent lamp.	
IV	Thermal conductivity of metal by Searle's apparatus.	
V	Verification of Stefan's law.	
VI	J by Callendar and Barn's method.	
VII	Temperature coefficient of resistance by Callandar and Griffiths bridge.	
VIII	Thermal conductivity of Glass (Tube form)	
IX	Co-efficient of thermal expansion	
X	Thermo e.m.f by Potentiometer	

11. **Suggested Books:**

S.No.	Names of Books/Authors	Year of Publication
1.	M.W. Zemansky & R.H. Dittman ;Heat & Thermodynamics , McGraw Hill	1997
2.	F.,W. Sears & G.L.Salinger ;Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Narosa Publishing Company.	1998
3.	Kerson Huang ;Statistical Mechanics , John Wiley & Sons	1987
4.	E. Guha ;Basic Thermodynamics , Narosa Publishing Company	2002

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT :Chemistry

1. Subject: CY- **201M** Course Title: **Physical Chemistry -1**
2. Contact Hours: **L-2; T-1; P-0**
3. Examination Duration (Hrs): Theory **02** Practical **00**
4. Relative weightage: CWS **25** PRS - MTE **25** ETE **50**
5. Credits: **03** 6. Semester: **Autumn**
7. Pre-requisite: **CY-101**
8. Subject Area: **BSC**
9. Objective of Course:

To make students familiar with the essentials of Physical Chemistry and to build foundation for learning advanced topics in the area.

10. Details of Course:

S.No.	Particulars	Cont. hrs.
1	**Colloidal state:** Introduction, coagulation, kinetics of coagulation, sensitization, protection, stability of sols, electrophoresis, electro osmosis, origin of charge, determination of charge and zeta potential, emulsions, gels, Liesegang ring phenomenon, sol-gel transformation, thixotropy.	5
2	**Chemical kinetics:** Introduction to its concepts, differential and integrated rate expressions for various reactions, methods for studying the kinetics of reactions, theories of reaction rates, complex reactions.	7
3	**Phase rule:** Concepts and derivation of phase rule, phase diagrams of 1,2 and 3 component systems, Lever rule.	7
4	**Electrochemistry:** Introduction, anomaly of strong electrolytes, interionic attraction theory, Debye – Hückel – Onsager equation, Wein effect, Debye – Falkenhagen effect, types of electrodes, galvanic cells, liquid junction potential, concentration cells with and without transference, polarization, decomposition voltage, over voltage.	9
	Total	28

Suggested books:

S.No.	Authors/ Title/ Publisher	Year of Publication
1	Levine IN, Physical Chemistry, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 5th Ed	2001
2	Silbey RJ, Alberty, RA, Physical Chemistry,John Wiley & Sons, Inc., 3rd Ed.	2003
3	Atkins PW, Physical Chemistry, Oxford University Press, 6th Ed	1998

12

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT :**Chemistry**

1. Subject: **CY- 211M** Course Title: **Inorganic Chemistry**
2. Contact Hours: **L-02; T-01; P-0**
3. Examination Duration (Hrs) Theory **02** Practical **00**
4. Relative weightage: CWS **25** PRS **-** MTE **25** ETE **50**
5. Credits: **03** 6. Semester: **Autumn**
7. Pre-requisite: **CY-101**
8. Subject Area: **BSC**
9. Objective of Course: **To impart knowledge of structure, bonding and reactivity of compounds of s, p, d and f-block elements.**
10. Details of Course

s.no	Particulars	Contact Hours
1	**Periodic trends and its relation to chemical bonding and reactivity.**	2
2	**Introduction to molecules and their chemical bonding:** Simple molecules, macromolecules and supramolecules. Ionic bonding: energetics of ionic bond, and lattice energy. Covalent bonding: energetics of covalent bond in hydrogen molecule –valence bond theory, VSEPR concept and hybridization (involving s, p, d orbitals) and shapes of molecules of higher (5, 6 and 7) co-ordination numbers, elementary ideas of molecular symmetry; Molecular orbital theory of both homo- and hetero-nuclear diatomic molecules, resonance and delocalized molecular orbitals; H-bonding, inter- and intramolecular and their effects; Weak intermolecular forces. Metallic bonding: band model, soft X-ray spectra and N(E) curves, binding energy in metals, conductors, semiconductors and insulators, effect of temperature and impurity on conductivity.	8
3	**Representative chemistry of main group elements:** solvated electron in alkali metals, multicentre bonds; structures, bonding and applications– boron halides, diborane, tetraborane, borazines, boron nitrides, crown ethers, carbides, fullerenes, fluorocarbons, silicon halides, silicates, siloxanes, silicon polymers, phosphonitrilic halides, synthesis, structures and reactivity of compounds of xenon, bonding in xenon fluorides.	6
4	**Principles and applications of transition metal chemistry:** Variable valency, colour, spectral, magnetic and catalytic properties, ability to form complexes, stability constant of coordination compounds, importance of transition metals in biological systems and in medicine	4
5	**Lanthanides and actinides:** Separation and isolation of lanthanides, separation of Np, Pu and Am from U, comparison of lanthanides and actinides, and their applications in technology.	2
6	**Introduction of metal ions in medicine and materials:** Preliminary ideas on bio-inorganic chemistry, oxygen transport and storage, metalloenzymes.	6
	Total	**28**

11. Suggested books:

S. No.	Authors/ Title/ Publisher	Year of Publication
1	Greenwood NN and Earnshaw, A, Chemistry of the Elements, 2nd Ed., Butterworth Heinemann, Oxford.	1997
2	Cotton FA, Wilkinson G and Gaus PL, Basic Inorganic Chemistry, 3rd Ed., John Wiley & Sons, Inc, New York.	2002
3	Shriver DF and Atkins PW, Inorganic Chemistry, 3rd Ed., Oxford University Press.	1999
4	Huheey JE, Keiter EA and Keiter RL, Inorganic Chemistry, Principles of Structure and Reactivity, 4th Ed., Pearson Education Asia.	2001
5	Cotton FA, Wilkinson G, Murillo CA, Bochmann M, Advanced Inorganic Chemistry, 6th Ed., John Wiley & Sons, New York.	1999

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT :Chemistry

1. Subject: **CY-202 M** Course Title: **Organic Chemistry - 1**
2. Contact Hours: **L-3; T-1; P-0**
3. Examination Duration (Hrs) Theory **03** Practical **00**
4. Relative Weightage: CWS **25** PRS - MTE **25** ETE **50**
5. Credits: **04** 6. Semester: **Spring**
7. Pre-requisite: **CY-101**
8. Subject Area: **BSC**
9. Objective of Course: **To develop concepts of stereochemistry and organic reactions.**
10. Details of Course:

s.no	Particulars	Cont.hrs
1	**Nature of Bonding in Organic Molecules** Delocalised chemical bond, hyperconjugation, tautomerism, hydrogen bonding, aromaticity of benzenoid and nonbenzenoid compounds, Hückel rule, energy levels of pi-molecular orbitals in simple systems.Brief discussion on the strength of organic acids and bases.	05
2	**Stereochemistry** Configuration and chirality, optical isomerism of compounds containing chiral centres optical isomerism of compounds without chiral centres (allenes, spiro compounds, diphenyl derivatives, and compounds containing exocyclic double bonds). R, S- convention. Prochirality, enantiotopic and diastereotopic groups, methods of resolution. Geometrical isomerism in acyclic, cyclic, condensed and bridged systems and oximes (Beckmann rearrangement) E, Z-convention.	14
3	**Reactive Intermediates** General methods of generation, their reactivity and stability	04
4	**Aliphatic Substitution** SN_1, SN_2 and SNi mechanisms, stereochemistry, relative reactivity in substitutions, effect of substrate structure, attacking nucleophile, leaving group and reaction medium, neighbouring group participation, competitive reactions. Introduction to SE_1 , SE_2 and SEi reactions.	05
5	**Elimination Reactions** Introduction, discussion of E_1, E_2, E_1cB and E_2C mechanisms, stereochemistry, relative reactivity in elimination, effect of substrate structure, attacking nucleophile, leaving group and reaction medium, competitive reactions orientations/orientation of the double bond. Saytzeff and Hoffman rules, α-eliminations (Fritsch-Buttenberg-Wiechell rearrangements).	08
	Total	42

Suggested books:

S. No.	Authors/ Title/ Publisher	Year of Publication
1	Sykes P, Guide book to Mechanism in Organic Chemistry, Orient Longman.	2002
2	Morrison, and Boyd, Organic Chemistry, 6th Ed. Prentice Hall of India.	2001
3	March J, Advanced Organic Chemistry, John Willey & Sons.	1992
4	Eliel EL, Stereochemistry of Carbon Compounds, Tata McGraw Hill.	2002

14

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT :Chemistry

1. Subject: **CY-212** Course Title: Basics of Analytical, Nano, and Green Chemistry.
2. Contact Hours **L-2, T-1, P-4**
3. Examination Duration (Hrs) Theory **03** Practical **04**
4. Relative weightage: CWS **15** PRS **15** MTE **15** ETE **40** PRE **15**
5. Credits: **05** 6. Semester: **Spring**
7. Pre-requisite: **CY-101**
8. Subject Area: **BSC**
9. Objective of Course: **To build foundations of analytical-, nano-, and green chemistry.**
10. Details of Course:

S.No	Particulars	Cont. Hrs
1.	**Errors and statistical data handling:** errors- sources and minimization, significant figures, accuracy, precision, sensitivity, selectivity, standard deviation, control chart, confidence limit, test of significance, rejection of a result, *Q*, *t* and *F* tests, sampling and sample size.	4
2	**Volumetric Analysis:** Primary standards, theory of acid-base, redox, and precipitation titrations including Volhord's and Mohr's methods, iodometry, theories of indicators, complexometry, characteristics of metallochromic indicators. **Gravimetric Analysis:** Supersaturation and nucleation, rate of precipitation, purity of precipitates, co-and post-precipitation, homogeneous precipitation, organic precipitants, masking agent. **Acid Equilibria.**	12
3.	**Nano Chemistry:** • **Introduction:** Definition of nanoscale materials, different types, different physical and chemical synthetic routes, characterization of nanoscale materials by modern instrumental techniques. • **Physical and Chemical Properties of Nanoscale Materials:** Electrical properties, magnetic properties, optical extinction properties, unique optical signatures of various nanostructures, fluorescence, chemical reactivity, self-assembly of various nanostructures and its importance. • **Catalytic Aspects of Nanoscale Materials:** Catalysis using nanoparticles of metals and metal oxides with different sizes and shapes, useful chemical conversions using nanoparticles. • **Nanoscale Materials in Emerging Technologies:** Useful properties that can be exploited for applications, applications in the areas such as environmental remediation, adsorption, drug delivery, medical imaging, future prospects, precautions in using nanoparticles.	8
4.	**Green Chemistry:** Introduction, examples of green chemistry, catalysis and green chemistry, green solvents (water, CO_2, ionic liquids), solvent-free reactions, epoxidation of alkenes, multi-phase catalysis, environmentally benign solutions, renewable resources, alternative greener technologies (photochemistry, electrochemistry, sonochemistry and microwave assisted reactions) and alternative energy sources.	4
	Total	28

15

Experiments:

1. Determination of acetic acid in vinegar.
2. Determination of Ca content in chalk / milk powder as Ca-oxalate by permagnetometry.
3. Determination of copper gravimetrically.
4. Determination of Al in an aluminium alloy and determination of Mn, Mg and Zn in a mixture by use of fluoride ion as a damasking agent in complexometric (EDTA) titration.
5. Separation of naphthalene from its suspension in water by steam distillation
6. Separation of o/p nitrophenols.
7. Separation and isolation of leaf pigments from spinach leaves by chromatography.
8. Determination of pK_1 and pK_2 of dibasic acids.
9. Determination of composition of unknown mixtures by refractive index measurements.
10. Verification of Freundlich adsorption isotherm.
11. Growth kinetics of ZnO nanoparticles
12. Preparation of cadmium sulfide nanoparticles by water-in-oil microemulsion method
13. Synthesis of an aqueous ferrofluid containing magnetite nanoparticles
14. Preparation of amides by using microwave irradiation.

(Experiments to be chosen by the instructor in-charge)

Suggested books:

S. No.	Authors/ Title/ Publisher	Year of Publication
1	Day RA, Underwood, Quantitative Analysis, 6th Ed., Prentice Hall of India, New Delhi.	1999
2	Christian GD, Analytical Chemistry, 6th Ed., John Wiley & Sons Inc.	2004
3	Skoog DA, West DM, Holler FJ, and Crouch SR. Fundamentals of Analytical Chemistry, 8th Ed., Thomson Brooks/Cole.	2004
4	Klabunde K. J, (Ed.), Nanoscale Materials in Chemistry, Wiley-Interscience, NY.	2001
5	Rao CNR, Mueller A, and Cheetham AK, (Editors), The Chemistry of Nanomaterials: Synthesis, Properties and Applications, (Volumes 1 and 2), Wiley-VCH Verlag, Weinheim.	2004

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: Mathematics

1. Subject Code: MA-201 M

Course Title: Complex Analysis and Partial Differential Equations.

2. Contact Hours: L: 3 ; T: 1 ; P: 0 ;

3. Examination Duration(Hrs.): Theory 0 3 **Practical** - -

4. Relative Weightage: CWS 2 5 MTE 2 5 ETE 5 0

5. Credits: 0 4 **6. Semester:** [ ] [Y] [ ]

Spring Autumn Both

7. Pre – requisite: MA-101

8. Subject Area: BSC

9. Objective of the Course: To impart the knowledge of essential mathematical tools of complex analysis and partial differential equations.

10. Details of the Course:

S. No.	Particulars	Contact Hours
1	**Functions of a Complex Variable:** Limits, continuity and differentiability of functions of a complex variable: Analytic functions. Conjugate harmonic functions. Applications to the problems of potential flow.	8
2	**Conformal Transformations:**: Conformal mapping, mapping by elementary functions, Bilinear transformations, Schwarz-Christoffel transformation and their applications.	6
3	**Infinite Series of Complex Numbers and Functions**: Convergence and uniform convergence of series of complex numbers and functions. Properties of power series, radius of convergence.	6
4	**Complex Integration**: Line integrals of complex valued functions, Cauchy integral theorem and integral formulae, Liouville's theorem, fundamental theorem of algebra, maximum modulus principle. Taylor's and Laurent's expansions. Zeros and singularities. Cauchy residue theorem. Contour integration and its application.	10
5	**Partial Differential Equations:** Solution of first order quasi linear partial differential equations, four standard forms of PDE, solution of first order non-linear PDE using Charpit's method, solution of linear equations with constant coefficients, classification of second order PDE, solution of one dimensional wave and diffusion equation, Laplace equation in 2 and 3 dimensions.	12
	Total	**42**

17

11. **Suggested Books:**

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Brown J.A .and Churchill R.V., **Complex Variables and Applications,** 6th edition, Mc Graw Hill.	1996
2.	Kreyszig E., **Advanced Engineering Mathematics,** John Willey and Sons.	1999
3.	Grawal B.S., **Higher Engineering Mathematics,** Khanna Publishers.	2015
4.	Sneddon I.N., **Elements of Partial Differential Equations,** Mc Graw Hill.	1957

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: Mathematics

1. **Subject Code:MA -202 M** **Course Title:** Numerical Analysis
2. **Contact Hours:** L: 3 ; T: 1 ; P: 0 ;
3. **Examination Duration(Hrs.): Theory** 0 3 **Practical** - -
4. **Relative Weightage:** CWS 2 5 MTE 2 5 ETE 5 0
5. **Credits:** 0 4 6. **Semester:** ✓ Spring ____ Autumn ____ Both

7. **Pre – requisite:** MA-101
8. **Subject Area:** BSC.
9. **Objective of the Course:** To equip the students with the basic techniques of numerical methods.

10. Details of the Course:

S. No.	Particulars	Contact Hours
1	**Error Analysis:** Types of errors, propagation of errors, correct and significant digits.	3
2	**Roots of non-linear equations:** Bisection method, Regula-falsi method, modified regula-falsi method, Atkin's, Newton-Raphson method, direct iterative method with convergence criteria. Extension of Newton-Raphson method to the solution of non-linear equations in two or more variables	7
3	**System of linear equations:** Gauss elimination method without and with partial pivoting, Crout's and Doo Little methods, Jacobi, Gauss-Seidel and Successive Over Relaxation Iterative methods with their convergence.	6
4.	**Eigen values and eigen vectors:** Dominant and smallest eigen values and eigen vectors by power method. Solution of homogeneous equations.	4
5.	**Interpolation:** Finite difference operators, difference tables and interpolation formulae- Newton's forward and backward, Stirling and Bessel formulae, Newton's divided difference, Lagrange's interpolation formulae. Errors in various formulae (without proof), Cubic spline interpolation, Inverse interpolation- successive approximation and Lagrange's method.	8
6.	**Numerical Differentiation:** Various formulae for first and second order derivatives.	2
7.	**Numerical Integration:** Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration and Gaussian quadrature formulae, errors in various integration rules.	4

8.	**Solution of first and second order ordinary differential equations:** Second and fourth order Runge-Kutta methods, Milne's,Adams-Bashforth methods, Predictor-Corrector method with errors. Solution of two-point boundry value problems by shooting and finite difference methods.	8
	Total	**42**

11. Suggested Books:

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Gerald, CF & Wheatley PO. **Applied Numerical Analysis**, 6th Edition, Wesley.	2002
2.	Jain, MK, Iyengar, SRK and Jain RK, **Numerical Methods for scientific and engineering computation**, New age pvt. Pub, New Delhi.	2000
3.	Conte, SD & De Boor C, **Elementary Numerical Analysis**, Koga Kusha.	1982
4.	Krishnamurthy, EV & Sen SK, **Applied Numerical Analysis**, East West Publication	1998

20

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: Mathematics

1. Subject Code: MA-203 **Course Title:** Mechanics-I

2. Contact Hours: L: 3 ; T: 1 ; P: 0 ;

3. Examination Duration(Hrs.): Theory 0 3 **Practical** - -

4. Relative Weightage: CWS 2 5 MTE 2 5 ETE 5 0

5. Credits: 0 4 **6. Semester:** Spring ✓ Autumn Both

7. **Pre – requisite:** NIL

8. **Subject Area:** BSC

9. **Objective of the Course:** The aim of the course is to introduce to the students the fundamentals of two-dimensional mechanics.

10. **Details of the Course:**

S. No.	Particulars	Contact Hours
1.	**Moment of Inertia** : Moment of Inertia of particles and solids of standard shapes. Centre of gravity.	4
2.	**Thin Beams and Flexible Cables:** Tension, Shearing force and Bending moment, general formulae for flexible cables hanging freely, common catenary, frames.	7
3.	**Virtual Work:** Infinitesimal displacement of rigid body parallel to fixed plane; Principle of virtual work, work and potential energy.	5
4.	**Stable and Unstable Equilibrium:** Potential energy, minimum energy principle for stable equilibrium, simple problems of stable equilibrium.	5
5.	**Kinematics of Particle and system:** Rectangular; Radial; transversed; tangential and normal velocities and accelerations, angular velocity and acceleration, principle of energy and angular momentum for a particle and a system.	7
6.	**Rectilinear Motion:** Motion with variable accelerations, harmonic oscillators, damped and forced oscillations.	4
7.	**Constrained Motion:** Motion of a particle in a vertical circle (inside and outside), in a cycloid, along a smooth plane curve.	4
8.	**Central Orbit:** Differential equation of a central orbit, law of force, velocity and periodicity for a given central orbit and the equation of orbit for a given law. Stability of a circular orbit. Planetary orbits, Keplers laws	6
	Total	**42**

21

11. Suggested Books:

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Shames I.H., **Engineering Mechanics: Statics and dynamics,** Prentice Hall of India.	2004
2.	Synge, J.L., & Griffith, **Principle of Mechanics,** Mc Graw Hill	1986
3.	Beer, F.P. & Johnston E.R., **Vector Mechanics for Engineers**, Tata Mc Graw Hill.	2005

22

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: Mathematics

1. **Subject Code:** MA-204 **Course Title: Linear Algebra**
2. **Contact Hours:** L: 3 ; T: 1 ; P: 0 ;
3. **Examination Duration(Hrs.): Theory** 0 3 **Practical** - -
4. **Relative Weightage:** CWS 2 5 MTE 2 5 ETE 5 0
5. **Credits:** 0 4 6. **Semester:** √ Spring ____ Autumn ____ Both

7. **Pre – requisite:** NIL
8. **Subject Area:** BSC
9. **Objective of the Course:** To introduce the basic concepts of linear algebra.
10. **Details of the Course:**

S. No.	Particulars	Contact Hours
1.	**System of linear algebraic equations:** Elementary row operations, row-reduced echelon form, Invertible matrices and their applications.	3
2.	**Vector spaces:** Definition of vector space, subspace, sum of subspaces, linear independence and dependence, basis and dimensions, infinite dimensional spaces, coordinates.	5
3.	**Linear transformations:** Definition, rank-nullity theorem, matrix representation, algebra of linear transformation, change of basis, solution of linear system AX=B. Applications to differential equations.	7
4.	**Canonical forms:** Characteristic equation, eigen values, eigen vectors, properties, diagonalization, minimal polynomial, Cayley-Hamilton theorem, generalized eigen vector, Jorden form, computation of matrix exponent.	14
5.	**Inner product spaces:** Cauchey-Schwartz inequality, triangular inequality, ortho-normal basis, Gram-Schmidt process.	6
6.	**Special matrices/Operators:** Hermitian, normal, unitary and projection operators, bi-linear, quadratic and Hermitian forms.	7
	Total	42

23

11. Suggested Books:

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Hoffmann K. and Kunze R, **Linear Algebra**, Prentice Hall of India	2002
2.	Charles W., **Linear Algebra**, Springer Verlag	2004
3.	Halmos P.R., **Finite Dimensional Vector Spaces**, Springer Verlag.	1974
4.	Peter J, Olver and Shakivban C., **Applied Linear Algebra**, Prentice Hall, New Jersey.	2005
5.	Dutta K.B., **Matrix and Linear Algebra**, Prentice Hall of India, New Delhi	2002

INDIAN INSTITUTE OF TECHNOLOGY
DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

1. **Subject Code: IHS-14** **Course Title: Fiction of the Indian Diaspora**

2. **Contact Hours:** L: 02; T: 01; P: 00

3. **Examination Duration (Hrs.):** Theory 02 Practical 00

4. **Relative Weightage:** CWS 25 MTE 25 ETE 50

5. **Credits:** 03

6. **Semester:** Spring [ ] Autumn [ ] Both Yes

7. **Pre-requisite:NIL**

8. **Subject Area: HSSMEC**

9. **Objective of the Course:** To familiarize students with the cultural dilemma that the diasporic communities face, and their varied emotional and literary responses to the situation by focusing on three or four internationally acclaimed writers.

10. **Details of the Course**

S. No.	Particulars	Contact Hours
1.	Introduction to fiction. The meaning of the term 'diaspora' and significance of the diasporic fiction.	03
2.	Introduction to the writers and their novels included in the study: the commonalities and the differences.	04
3.	Treatment of the cultural dilemma faced by the migrant communities. Meaning and significance of the terms 'acculturation', 'deculturation 'and 'transculturation'.	03
4.	Use of innovative literary devices such as myths, magical realism and the supernatural elements.	03
5.	In-depth analysis of selected novels included in the course: their thematic and stylistic interpretations.	12
6.	The significance, implications and impact of diasporic fiction on culture.	03
	Total	**28**

25

11. Suggested Books:

Sr. No.	Name of Books/Authors	Year of Publication
1.	Bhabha, Homi. Location of Culture, London: Routledge.	1994
2.	Brah, Avtar. Cartographies of Diaspora: Contesting Identities. London: Routledge.	2002
3.	Said. Edward. Culture and Imperialism. London: Vintage.	1994
4.	Ro Fludernick, Monika. Ed. Diaspora and Multiculturalism, Common Traditions and New Developments . New York : Rodopi B.V.	2004
5.	Mongia, Padmini Ed. Contemporary Postcolonial Theory : A Reader. New Delhi : Oxford UP.	1996
6.	Nelson, Emmanuel S Ed. Writers of the Indian Diaspora : A Bibliographical Critical Sourcebook Westport : Greenwood Press.	1993

26

INDIAN INSTITUTE OF TECHNOLOGY
DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

1. **Subject Code: IHS-15** **Course Title: Creative Writing in English**
2. **Contact Hours:** L: 02; T: 01 P: 00
3. **Examination Duration (Hrs.):** Theory 02 Practical 00
4. **Relative Weightage:** CWS 25 MTE 25 ETE 50
5. **Credits:** 03
6. **Semester:** Spring [ ] Autumn [ ] Both Yes
7. **Pre-requisite:** Nil
8. **Subject Area: HSSMEC**
9. **Objectives of Course:** To familiarize students with the nature, scope and process of creative writing and to encourage their creative potential.
10. **Details of the Course:**

Sl. No.	Particulars	Contact Hours
1.	Defining creative writing: introduction, choice of words, images. Modes of writing: biographical, travelogue, memoirs	05
2.	Reading and writing poetry; forms, styles, types, rhymes, imagery, symbolism. Important literary terms and various trends: Discussion and seminar	08
3.	Features of short story: character, plot, settings, and prose style	03
4.	Novel and drama; differences; narrative techniques; dialogues. Drama and theatre: history, background, action, plot, protagonist, and conflict. Description, exposition, development and ending. Radio& TV plays. Analysis of some important literary works.	12
Total		**28**

27

11.Suggested Reading:

Sl. No.	Author/Book	Year of Publication
1.	Mills, Paul. Creative Writing: Course Book. Routledge.	2006
2.	Jaron, Philip K & Allan h. Lefcountz. Creative Writer's Hand Book.4th Edition. Prentice Hall	2004
3.	Bulman, Colin .Creative Writing: A Guide and Glossary to Fiction Writing .Polity Press.	2005
4.	Hudson W.H.: A Background to the Study of Literature . Delhi : OUP	2004.
5.	Carole Kiler Doreski. How to Read and Interpret Poetry. 2nd ed. CUP	2006

INDIAN INSTITUTE OF TECHNOLOGY

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

1. **Subject Code: IHS-16** **Course Title: Linguistics**

2. **Contact Hours:** L: 02; T: 00; P: 02

3. **Examination Duration (Hrs.):** Theory 02 Practical :00

4. **Relative Weightage:** CWS 15 PRS 15 MTE 30 ETE 40

5. **Credits:** 03

6. **Semester:** Spring [ ] Autumn [ ] Both [Yes]

7. **Pre-requisite:** NIL

8. **Subject Area: HSSMEC**

9. **Objectives of Course:** To acquaint students with the nature and function of English language on linguistic basis and also its role in the changing global scenario

10. **Details of the Course:**

Sl. No.	Particulars	Contact Hours
1.	Defining Linguistics; introcuction, origin and development of language .Special features and properties of language. Animal and human communication.	04
2.	Phonetics: Difference between phonetics and phonology	04
3.	Morphology; morphemes: free and bound morphemes: morphological descriptions segmentals and supra segmentals. Word formation	05
4.	Syntax , Semantics& Pragmatics	03
5.	Discourse analysis & language change	03
6	Psycholinguistics: brain, atmosphere and language	03
7.	Language varieties & Sociolinguistics: standard language, regional dialects, register, slang, pidgin, Creole, bilingualism	06
Total		**28**

29

11. **Suggested Reading:**

Sl. No.	Author/Book	Year of Publication
1.	Yule, G. The Study of Language. Cambridge Univ. Press	2006
2.	Verma,S.K and Krishnaswami. Modern Linguistics: An Introduction. Delhi:OUP	2005
3.	William O'Grady, Michael Dobrovolsky, Francis Katamba: Contemporary Linguistics: An Introduction. London: Longman	2004
4.	Dinneen, Francis P. An Introduction to General Linguistics. New York: Holt, Rinehart, and Winston.	1997
5.	Crystal, David. Linguistics. Baltimore: Penguin Books.	2000

30

INDIAN INSTITUTE OF TECHNOLOGY

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

1. **Subject Code:** HS-74 **Course Title:** **Environmental Economics**

2. **Contact Hours:** L: 02; T: 01; P: 0

3. **Examination Duration (Hrs.):** Theory 02 Practical 00

4. **Relative Weightage:** CWS 25 MTE 25 ETE 50

5. **Credits:** 03

6. **Semester:** Spring [ ] Autumn [ ] Both Yes

7. **Pre-requisite:** HS-201 (Economics)

8. **Subject Area:** HSSMEC

9. **Objective of the Course:** To enrich the understanding of the students about various issues related to the economy and environment and endow them with basic concepts and theories of environmental economics with greater emphasis on application.

10. **Details of Course**

S. No.	Particulars	Contact Hours
1.	Introduction: Meaning of environmental economics, basic concepts and tools	2
2.	Environment and Development: Poverty, environment, and economic growth, concept of sustainable development	3
3.	Efficiency and Markets: Concept of efficiency, Pareto optimality, efficiency and competitive markets, efficiency in exchange of goods and bads	3
4.	Market Failure and Policy Instruments: Public and private bads, externalities, standards, taxes and subsidies	4
5.	Environmental demand theory: Concept of demand for environmental goods, types of environmental goods. Consumer demand for environmental goods, welfare effects of a price change	3
6.	Environmental Cost-benefit analysis: Meaning, major steps, pollution cost, benefits from controlling pollution , efficiency in pollution control, limitations of cost-benefit analysis	2
7.	Property rights: The rights of polluter and the victim, The Coase Theorem and its policy significance	3
8.	Environmental regulations: Rationale for regulations, basic regulatory instruments, issues and effects of environmental regulations	3
9	Environmental Policy of India: Objectives, strategy, features, and effectiveness	2
10	Case Studies	3
	Total	**28**

31

11. Suggested Books:

Sr. No.	Name of Books/Authors	Year of Publication
1.	Environmental Economics by Charles D. Kolstad, Oxford university Press, First Indian Edition, New Delhi.	2006
2.	Environmental and Natural Resource Economics by Tom Tietenberg, 7th ed., Addison Wesley Longman, Inc.,	2006
3	Environmental and Natural Resources Economics: Theory, Policy, and the Sustainable Society by Steven C. Hackett, 3rd ed. M.E. Sharpe, New York	2006
4	Environmental Economics by Ulaganathan Sankar, Oxford University Press	2001
5	Introduction to Environmental Economics by Nick Hanley, Oxford University Press	2001
6	Handbook of Environmental Economics by Daniel W. Bromley Blackwell Publishing	1995
7.	Annual Report of Ministry of Environment and Forests, Government of India, New Delhi	-

32

Appendix 'B'
Item No. Senate/20.2

Guidelines for framing the curriculum structures for various B.Tech., IDD and Integrated Programmes:.

1. For all programmes:

   (a) In any semester, not more than 24 credits be assigned.

   (b) In the second year, upto seven theory courses may be assigned and in any semester after second year, not more than six theory courses be assigned.

   (c) Except for the Institute Elective/Departmental Elective courses which may run in both semesters, the courses to be run in Autumn semester be assigned odd numbers and courses to be run in spring semester be assigned even numbers.

2. For B.Tech programmes, in the VIIIth semester, project and not more than three theory courses be assigned.

3. For IDD (M.Tech.) programmes:

   (a) IXth semester should consist of seminar, project and Dissertation only,

   (b) The Xth semester should consist of Dissertation only.

4. For five year integrated M.Sc. (Physics/Chemistry/Applied Mathematics) programmes, Xth semester should consist of Dissertation, Seminar/Project and at most one theory course.

5. For five year integrated M.Tech. programme (Polymer Science, Geological Tech, Geophysical Tech.)

   (a) The IXth semester should consist of Dissertation, Seminar, Project and at most one theory course,

   (b) Xth semester should consist of dissertation only.

6. For five year IDD (Process Engg.+ MBA), it was recommended that the major project in the 4th year be of 8 credits and Deptt of Paper Technology, be requested to adjust the credits of IEC accordingly.

7. All the departments should include more 4 credit courses with a loading of (3-1-0 or 3-0-2) in place of 3 credit courses which will reduce the number of courses per semester and also provide an opportunity for the departments to give in depth knowledge of the subject.

Appendix 'C'
Item No. Senate/20.3

GUIDELINES FOR FRAMING PROPOSALS FOR VISIT OF INTERNATIONAL STUDENTS FOR SHORT DURATION

International students be allowed to join the Institute for a short term duration for course work/training/ project in all Undergraduate/Postgraduate Programmes of the Institute, subject to following conditions.

1) The duration of course/training/project will not be more than one year;

2) The bench fee will be as follows:

   (i) 50 US$ per credit with a minimum of US$500(Five Hundred) per semester for students from SAARC countries;

   (ii) 100 US$ per credit with a minimum of US$ 1000(One Thousand) per semester for students from other countries;

3) The fee charged will cover the hostel rent also. The students will have to pay mess charges as being charged from other hostel inmates;

4) In each semester the maximum number of students allowed to join a Department/Centre will be 02 (two);

5) The applications of the candidates, duly forwarded by their parent Institution, will be received by the department /centre of the candidate's specialization which will forward the suitable applications to concerned Dean (UGS or PGS&R) for final approval. International projects and the exchange covered under MoUs, is beyond these provisions.

6) Foreign students will be admitted as per the MHRD guidelines issued from time to time. For the present, the guidelines issued vide MHRD letter F.No. 35-21/2007-TS-I dated 10th July 2007, will be followed, wherein political clearance will be obtained from the Ministry of External Affairs in those cases where the students belong to Afghanistan, Bangladesh, China, Pakistan or Sri Lanka.

Appendix 'D'
Item No. Senate/20.7

VARIOUS ISSUES DECIDED BY THE MEETING OF THE WORKING GROUP OF TECHNICAL EDUCATION, MHRD HELD ON JUNE 26, 2007.

1. Lateral Entry to Engineering after B.Sc.

The Committee considered the consensus of the meeting of the Working Group on Technical Education contained in the note of Shri Yatendra Kumar, Under Secretary to the Government of India, Ministry of Human Resource Development. After detailed deliberations, the Committee found that Lateral Entry to Engineering after B.Sc. is not possible in IIT system as the admissions to B.Tech. and 5-years Integrated Programmes are made through JEE.

2. M.Tech. Programme Integrated with Engineering Education and Research.

The Committee feels that probably this is the new edition of 5-year Integrated Dual Degree Programmes in Engineering (B.Tech. + M.Tech.). The suggestions of the Working Group on Technical Education is that we should offer only one M.Tech. Programme. The Working Group on Technical Education is silent on the duration of the course. The Committee is in favour of promoting more 5-year IDD programmes in different Departments of the Institute. It is felt that we should further strengthen our IDD programmes.

3. Post B.Tech. Integrated Ph.D. Programme

The Committee feels that existing Ph.D. regulations also have a provision for admitting B.Tech. candidates directly to Ph.D. programme. However, the students do not have an exit option with M.Tech. degree after completing a specified number of courses and dissertation, if for any reason whatsoever, they are not able to complete their Ph.D. programme. It is felt that this option should be available to the candidates having only B.Tech. degree and admitted to the Ph.D. programme. However, the following conditions shall be applicable to such candidates:

(a) That they must have qualified GATE and would otherwise be eligible for admission to M.Tech. in IIT Roorkee.

(b) That the assistantship to such students shall be equivalent to that of M.Tech. students or JRF in Sciences for the first two years. If they do not exit the Ph.D. programme after two years and continue with the Ph.D. programme, they may be considered for enhanced assistantship equivalent to that for Ph.D. students, retrospectively for the last two years. However, they will be provided with the normal Ph.D. assistantship for the next two years of the programme.

Appendix 'E'
Item No.Senate/20.8

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **PH-101** Course Title: **Physics I**

2. Contact Hours: L: 3 ; T: 1 : P: 2 ;

3. Examination Duration (Hrs.): Theory 0 3 Practical 0 2

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 15 **ETE** 40 **PRE** 15

5. Credits: 05 6 Semester: Autumn ____ Spring ____ Both √

7. Pre-requisite: None 8. Subject Area: CC

9. **Objective of Course:** To expose students to the basic aspects of vector fields to help them get familiarized with fundamentals of Electricity and Magnetism and with Maxwell's equations and their applications.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Vector Fields:** Vector transformation, Vector calculus, Divergence and curl in curvilinear coordinates. Divergence and curl of electrostatic fields, Electric potential, Laplace's and Poisson's equation, Divergence and curl of magnetic field, Magnetic vector potential.	12
2.	**Electromagnetic Waves:** Maxwell's equations, Conservation of charge and energy, Electromagnetic waves in vacuum and in matter, Polarized and unpolarized e.m.waves. Absorption and dispersion.	10
3.	**Wave Particle Duality and Quantization:** Blackbody radiation, photoelectric effect, Compton effect, DeBroglie waves, Electron Diffraction, Davisson-Germer experiment, Uncertainty principle, Bohr atom model and Sommerfeld corrections, Franck-Hertz experiment.	08
4.	**Elements of Quantum Mechanics:** Basic postulates of quantum mechanics and meaning of measurement, Schrödinger wave equation, idea of wave function, expectation values, stationary states, particle in a box, finite potential well, potential barrier and tunneling, one dimensional harmonic oscillator	12
		42
5.	**List of Experiments:**	
	(i) Measurement of magnetic susceptibility by Quinck's method.	
	(ii) Verification of Malu's Law.	
	(iii) Determination of Planck's constant by photoelectric effect.	
	(iv) Verification of Brewster's Law.	
	(v) Polarization of Laser light.	
	(vi) Single-slit, double slits and multiple slits diffraction by Laser.	
	(vii) Determination of Planck's constant by radiation method.	
	(viii) B-H Loop.	
	(ix) Stefen's constant.	
	(x) Magnetic field of paired coils in Helmholtz arrangement.	
	(xi) Davisson-Germer Experiment.	

36

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	Introduction to Electrodynamics by David J. Griffiths, Prentice Hall of India (3rd Edition)	1999
2.	Concepts of Modern Physics by Arthur Beiser, Tata Mc Graw Hill (6th Edition)	2003
3.	Elements of electromagnetics by Matthew N.O. Sadiku, Oxford University Press (3rd Edition)	2003
4.	The Feynman Lectures on Physics, Volume I & II by R.P. Feynman, R.B. Leighton and M. Sands, Narosa Publishing House	2003

37

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **PH-201** Course Title: **Physics II**

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory 0 2 Practical 0 0

4. Relative Weightage: **CWS** 15 **PRS** 00 **MTE** 35 **ETE** 50 **PRE** 00

5. Credits: 03 6. Semester: Autumn / Spring / Both

7. Pre-requisite: Physics I 8. Subject Area: BS

9. **Objective of Course:** The course would familiarize students with the basic principles of quantum mechanics and its applications in the areas of Atomic, Solid State and Nuclear Physics.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Atomic Structure:** Hydrogen atom (qualitative), angular momentum quantization, space quantization, electron spin, Stern-Gerlach experiment, vector atom model, fine structure of H_α line.	06
2.	**Photonics:** Distribution function of classical and quantum particles, Elements of classical and quantum statistics. Basic ideas of laser and its properties, Einstein's A and B coefficients, ruby laser, He-Ne laser, basic idea of holography, optical fiber for telecommunication.	07
3.	**Solid state physics:** Crystal structure, Free electron theory of metals, electron in a periodic potential, Kronig-Penny Model, effective mass, origin of the energy gap, band theory of solids, classification solids into metals, semiconductor and insulators, magnetic properties of solids. Concepts of electrons confinement in low dimensions, quantum wells and superlatices leading to nanodevices. Essential properties of superconductors, zero resistivity, Meissner effect, isotope effect, heat capacity, Energy gap, Type-I & II superconductors, Levitation.	14
4.	**Nuclear structure:** Binding energy and stability of nuclei, Liquid drop model and shell model, applications in nuclear energy.	05
5.	**Special Relativity:** Postulates of special relativity, Lorentz transformation, Introduction to four-vectors, Time dilation, Doppler effect, Length contraction, Twin paradox, Relativistic momentum, Mass and energy, energy and momentum, Relativity as bridge between electricity and magnetism, Magnetism as a relativistic phenomenon (Qualitative discussion).	10
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Concepts of Modern Physics by Beiser, Tata McGraw Hill	2003
2.	Lasers and Nonlinear Optics by B. B. Laud, Wiley Eastern	2000
3.	Introduction to Solid State Physics by Kittel, John Wiley	2004
4.	Nuclear Physics – Principles and Applications by Lilley, John Wiley	2001
5.	Introduction to Modern Physics by Mani and Mehta, Affiliated East West Press	1991
6.	The Feynman Lectures on Physics, Volume III by R.P. Feynman, R.B. Leighton and M. Sands, Narosa Publishing House	2003
7.	Modern Physics for Scientists & Engineers by S.T. Thornton & A. Rex, Sanders College Publishing, 2nd Edition.	2000

39

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Metallurgical & MaterialsEngineering

1. **Subject Code:** MT-201B **Course Title:** Material Science B
2. **Contact Hours:** L: 3 ; T: 1; P: 0
3. **Examination Duration (Hrs):** **Theory:** 0 3 **Practical:** 0 0
4. **Relative Weightage:** **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **RRE:** 0 0
5. **Credits:** 0 4 **6 Semester:** √ (Autumn) ☐ (Spring) ☐ (Both)
7. **Pre-requisite:** None
8. **Subject Area:** ESC
9. **Objective of the Course:** To familiarise the students with the fundamentals of the structure property correlation of the materials and to develop the new materials and alloys on that basis

10. **Details of the Course:**

Sl. No.	Particulars	Contact Hours
1.	Introduction to crystallography, Crystal defects: Point defects, Line defects (dislocations), surface defects and volume defects	6
2.	Principles of alloy formation: Primary and intermediate phases, their formation, solid solutions, Hume Rothery rules.	4
3.	Binary equilibria: Binary phase diagrams involving isomorphous, eutectic, peritectic and eutectoid reactions. Phase rule, lever rule, effect of non-equilibrium cooling on structure and distribution of phases. Some common binary phase diagrams viz: Cu-Ni, Al-Si, Pb-Sn, Cu-Zn, Cu-Sn and Fe-C and important alloys belonging to these systems.	6
4.	Mechanical Properties: Hardness, Tensile Properties, Fracture-ductile and brittle, ductile-brittle transition; Introduction to fracture toughness, introduction to fatigue and creep properties, creep resistant materials (super alloys; nimonics, inconel etc.	6

40,

5.	Heat Treatments: Basic principles of heat treatment of steel, TTT and CCT diagrams, common heat treatments like Annealing, normalizing, quenching (hardening) tempering, Martempering and Austempering. Heat treatment of non-ferrous alloys: precipitation hardening/age hardening. Surface hardening: Flame hardening, Induction hardening and chemical hardening.	6
6.	Engineering Materials: ferrous materials: Classification of steels and their applications non-ferrous materials: Al, Cu, Mg and Ti base alloys	6
7.	Advanced materials: Composite Materials: Introduction, types of composite materials, Factors affecting properties of composite materials, polymeric materials: Introduction to polymeric materials, processing of plastic materials, Types of plastic and their applications, Ceramic materials: Introduction, Structure and properties of ceramics, Application and processing of ceramics, Advanced ceramics.	8
	Total	**42**

11. Suggested Books:

S.No	Name of the Books/Publisher	Year of Publications
1.	Material Science and Engineering – A first course fourth edition, V. Raghvan Prentice Hall of India, New Delhi.	2001
2.	The science and engineering of materials, 3rd Ed., PWS Publishing Co., Boston, D.R. Askeland.	1994
3.	Materials science and engineering and introduction – WD Callister, Jr. John Wiley & Sons, Inc., 5th Ed.	2000
4.	Introduction to physical metallurgy, Sidney H Avner – McGraw Hill Book Company	1974
5.	Engineering materials 2 An introduction to microstructures processing and design-MF Ash by and David RHJones, Third Edition, B/H Elsevier	2006
6.	Physical metallurgy: Principles and practice-V. Raghvan, PHI Pvt. Ltd, New Delhi	1993

12. List of Practicals: Nil

41