5. Heterocyclic Chemistry by J A Joule and Smith.
6. Handbook of Heterocyclic Chemistry by A R Katritzky

Additional Study Material: Heterocyclic Chemistry

https://nptel.ac.in/content/syllabus_pdf/104105034.pdf

https://nptel.ac.in/courses/104/105/104105034/

CCPP-3, CHO-354: Practical-I Solvent Free Organic Synthesis

[96L +24T]

Note:

The students should perform any 24 Syntheses from the following list. Students should acquire **pre-experiment** (Reading MSDS, purification of reactants and reagents, mechanism, stoichiometry etc) and **post-experiment** skills (work-up, isolation and purification of products, physical constants characterization using any spectroscopic methods etc.)

A) Solvent Free Carbon–Carbon Bond Formation

1. Pinacol coupling reaction (Page 36)
2. Reformatsky reaction/Luche reaction (Page 36)
3. Knoevenagel condensation (Page 40)
4. Dieckmann condensation (Page 42)
5. Corrole Synthesis (Page 42)
6. Knoevenagel condensation, 3-carboxycoumarin (Page 45)
7. 3-(ethoxycarbonyl)-4-hydroxy-5-(1-hydroxyalkyl)-2-isoxazoline-2-oxide (Page 46)
8. Biginelli reaction (Page 46)
9. Claisen reaction(Page 47)
10. Pechmann reaction (Page 50)
11. calix[4]resorcinarene (Page 50)

B) **Solvent-Free C–N Bond Formation**

1. terephthalic acid dihydrazide (Page 205)
2. azomethine synthesis (Page 213)
3. diazepinone synthesis (Page 218)
4. dibenzyl sulfone Synthesis (Page 297)

C) **Solvent-Free C–S Bond Formation**

1. 1,3-dithiolane synthesis (Page 299/300)

D) **Solvent-Free C–X Bond Formation**

1. Cinnamic acid/ stilbene halogenations (Page 319)
2. Phenol bromination using , *N*-bromosuccinimide (Page 320)

E) **Solvent-Free N–N Bond Formation**

1. Triazenes Synthesis (Page 335)
2. Beckmann rearrangement (Page 346)

F) **Other Solvent-Free Reactions**

1. D-mannitol protection using phenylboronic acid (Page 388)
2. Baeyer-Villiger reaction
3. 2-Hydroxybenzaldehyde oxidation using urea-hydrogen peroxideComplex (Page 13)
4. Alumina-supported permanganate oxidation (Page 15)
5. Sulfide oxidation using MnO_2 (Page 21)
6. Oxidative coupling of thiol using MnO_2 (Page 22)
7. Iodine catalysed S-S bond formation of Cystine (Page 28)

G) Solvent free supramolecular assembly formation

1. Caffeine and oxalic acid (Page 420)
2. *rac*-*Bis*-beta-naphthol and benzoquinone
3. Isovaleraldehyde and pyrogallol

Reference:

Solvent-free Organic Synthesis by Koichi Tanaka (Copyright © 2009 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 978-3-527-32264-)

Additional Study Material: https://nptel.ac.in/courses/104/106/104106108/

Semester IV

CCTP- 10, CHO-450: Chemistry of Natural Products [48L +12T]

Section I: [24 L + 6 T]

1. Understanding and planning of total synthesis while maintaining the stereochemistry. A case study: **Longifolene** – (All Nine syntheses from Advanced Organic Chemistry Carey, Sundberg; Part B). **[12 L]**

2. Total Synthesis of

i. Hirsutellone B (Angew. Chem. Int. Ed. 2009, 48, 6870 –6874.)

ii. Ribisins A and B : (J. Org. Chem. 2019, 84, 15165−15172)

iii. Subincanadine E : **(*For Self-Learning)** (J. Org. Chem. 2017, 82, 11126-11133) **[12 L]**

Section II : [24 L + 6 T]

A) Vannusals

References:

1.J. Am. Chem. Soc. 2010, 132, 20, 7138-7152.
2.J. Am. Chem. Soc. 2010, 132, 20, 7153-7176.
3.Angew. Chem. Int. Ed. 2009, 48, 5642 –5647.
4.Angew. Chem. Int. Ed. 2009, 48, 5648–5652

B) **Pinnaic acid**

References:

1. Angew. Chem. Int. Ed. 2001, 40 (23), 4450-4452.
2. Angew. Chem. Int. Ed. 2001, 40, (23), 4453-4456.
3. Angew. Chem. Int. Ed. 2007, 46, 5746–5749

CCTP- 11, CHO-451: Organometallic Reagents in Organic Synthesis [48 L + 12T]

1. Transition metal complexes in organic synthesis; Pd, Ni, Ru, Fe, Ir and Cu only (C-C, C-N, C-O bond formation reactions with catalytic cycle, ligand and % mole concepts)**[18 L]**
2. C=C formation reactions: Wittig, Horner-Wordworth-Emmons, Shapiro, Bamford-Stevens, McMurry, Julia-Lythgoe and Peterson olefination reactions. **[6 L]**
3. Multi-component reactions: Ugi, Passerini, Biginelli and Mannich reaction **[3 L]**
4. Ring formation reactions: Pausan-Khand, Bergman and Nazerov cyclization **[3 L]**
5. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions. Click reactions in synthesis of bioconjugates **(sugars and proteins)** **[4 L]**
6. Metathesis: Schrock and Grubbs catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, application in polymerization and synthesis of small organic molecules**.** **[6 L]**
7. Use of Boron and Silicon reagents in organic synthesis. **[8 L]**
8. Other important reactions: Baylis Hilman, Eschenmoser-Tanabe fragmentation, Mitsunobu reaction**. [*Self Learning]**

References:

1. C–N bond forming cross-coupling reactions: an overview: by Jitender Bariwalab and Erik Van der Eycken *Chem. Soc. Rev.,* 2013, **42**, 9283
2. Iron Catalysis in Organic Synthesis Chem. Rev. 2015, 115, 3170–3387.